MECHANICAL ENGINEERING

January 1956

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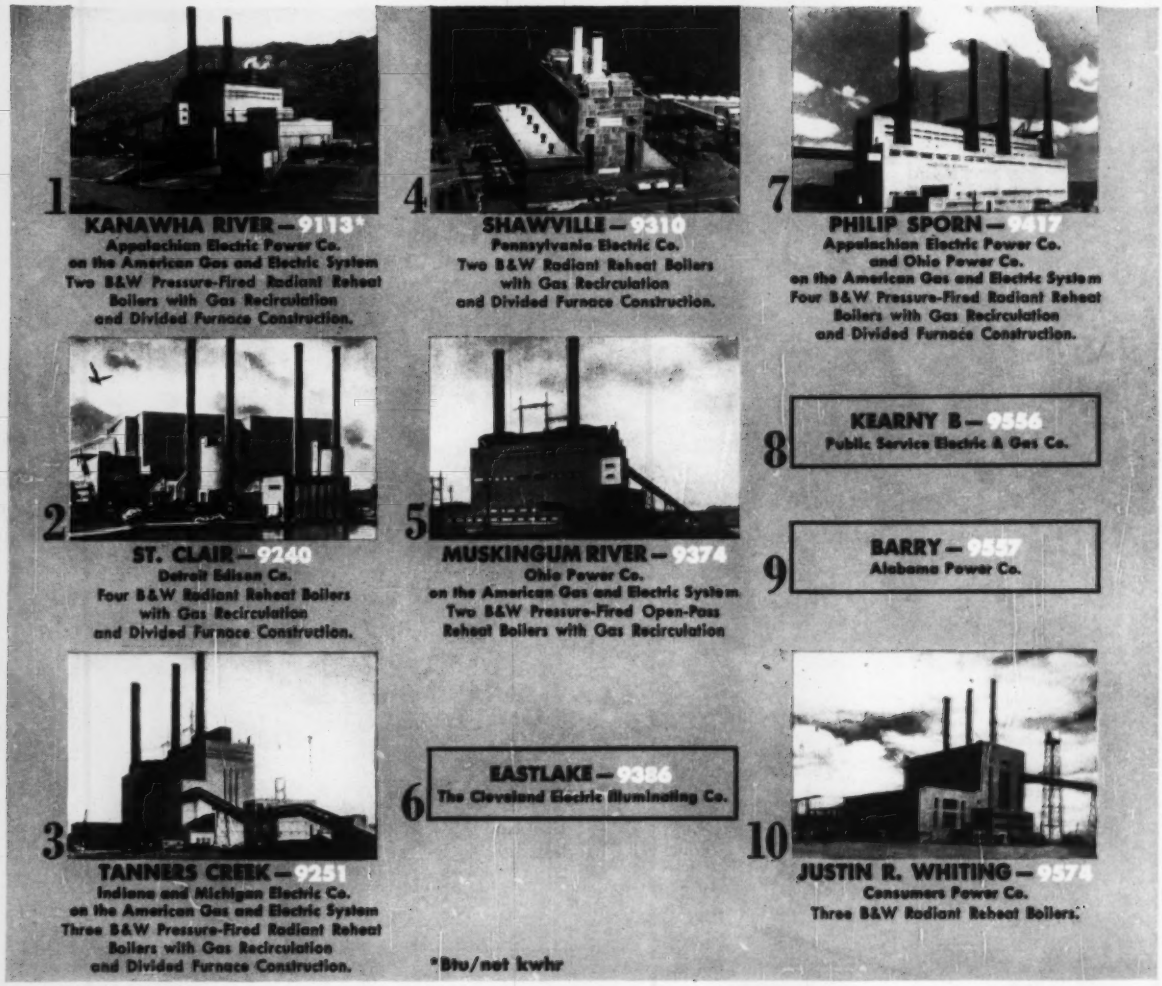

1
KANAWHA RIVER — 9113*
Appalachian Electric Power Co.
on the American Gas and Electric System
Two B&W Pressure-Fired Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.
4
SHAWVILLE — 9310
Pennsylvania Electric Co.
Two B&W Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.
7
PHILIP SPORN — 9417
Appalachian Electric Power Co. and Ohio Power Co.
on the American Gas and Electric System
Four B&W Pressure-Fired Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.
2
ST. CLAIR — 9240
Detroit Edison Co.
Four B&W Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.
5
MUSKINGUM RIVER — 9374
Ohio Power Co.
on the American Gas and Electric System
Two B&W Pressure-Fired Open-Pass Reheat Boilers with Gas Recirculation
8
KEARNY B — 9556
Public Service Electric & Gas Co.
9
BARRY — 9557
Alabama Power Co.
3
TANNERS CREEK — 9251
Indiana and Michigan Electric Co.
on the American Gas and Electric System
Three B&W Pressure-Fired Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.
6
EASTLAKE — 9386
The Cleveland Electric Illuminating Co.
10
JUSTIN R. WHITING — 9574
Consumers Power Co.
Three B&W Radiant Reheat Boilers.
*Btu/net kwhr

LEADERS IN POWER PRODUCTION EFFICIENCY

Annual plant net heat rates of the ten most efficient central stations in the United States in 1954—as reported by the Federal Power Commission—are led by Kanawha's record 9113 Btu per net kwhr. This means that Kanawha River Station requires only 9113 Btu of heat energy from fuel to produce one kilowatt-hour of electricity—far, far less than was required just a few years ago. This improvement is being carried out simultaneously with tremendous expansion of economical electric power.

These ten stations are strong vindication of the foresighted utilization of major engineering advances which are taking this nation so far and so fast along the road of power generation progress. The development of these advances has been possible only through the efforts of the electric companies and their primary suppliers working cooperatively to provide more electricity more efficiently.

In most of these leading stations, B&W Boilers with advanced engineering features are contributing substantially toward achieving the remarkable efficiency levels reported. For example, at Kanawha the B&W vertically-fired Radiant Boiler units utilize pressure firing, Cyclone Steam Separators, divided furnace construction and other B&W engineering achievements.

Just behind the ten leaders are more plants—many with B&W Units—producing abundant, economical power across the country.

Welcoming its responsibilities, B&W continues to combine almost a century of experience with the practical results of an extensive research and development program in the effort to achieve still higher levels of steam-electric generating efficiency.

BABCOCK & WILCOX
BOILER DIVISION

N-207

FACTS

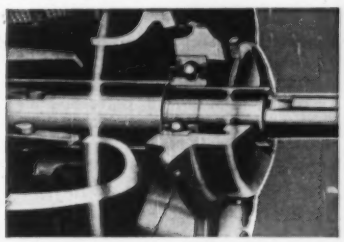
about

NEW DEPARTURE
BALL BEARINGS

Self-sealed bearings simplify design . . . cut maintenance costs

New Departure originated self-sealed ball bearings to eliminate the most common causes of bearing wear and failure—such as abrasive dirt and improper lubrication. Since then, more than 300,000,000 New Departure sealed bearings have been produced in various types to fit the specific requirements of industry. Seals are available to keep out foreign matter, ranging from dust and dirt to corrosive gases . . . to retain lubricants, varying from heavy grease to light oil . . . to provide the protection that assures longest life.

New Departure's latest advance, Sentri-Seal, embodies exclusive features which importantly improve both bearing performance and range of application. Because of its design, Sentri-Seal provides controlled, highly efficient sealing with low torque and is not materially influenced by axial movement due to bearing end play within prescribed tolerances.

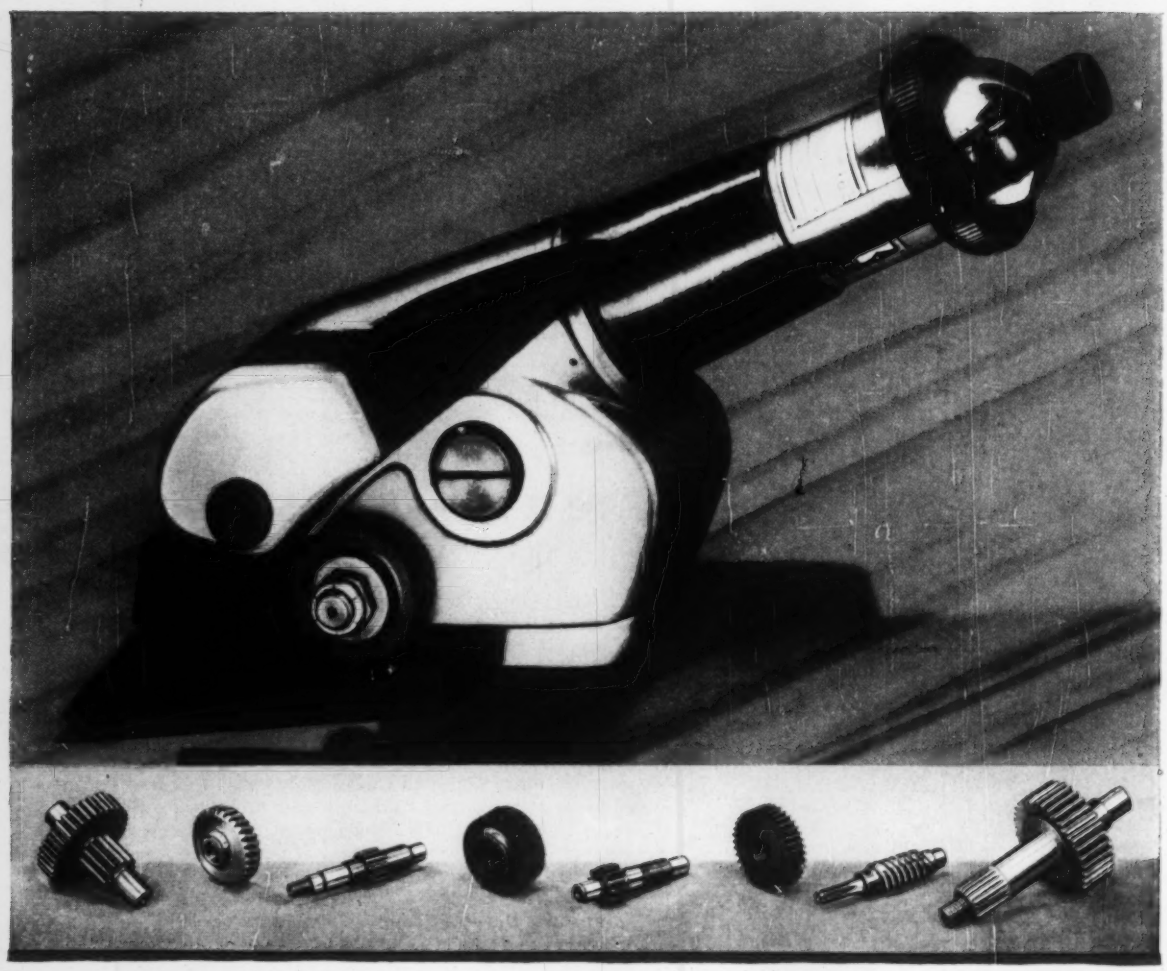


Sealed ball bearings offer the electric motor and machine tool builder many advantages. They simplify design, make it possible to mount motors in any position, cut maintenance to a minimum, and eliminate the need for relubrication for long periods of operation.

WRITE FOR COMPLETE INFORMATION ON NEW DEPARTURE SEALED BEARINGS!

NEW DEPARTURE • DIVISION OF GENERAL MOTORS CORPORATION • BRISTOL, CONN.

MECHANICAL ENGINEERING, January, 1956, Vol. 78, No. 1. Published monthly by The American Society of Mechanical Engineers, at 20th and Northampton Sts., Easton, Pa. Editorial and Advertising departments, 29 West 39th St., New York 18, N. Y. Price to members $3.50 annually, single copy 50¢; to nonmembers $7.00 annually, single copy 75¢. Add $1.50 postage to all countries outside the United States, Canada, and the Pan-American Union. Entered as second-class matter December 21, 1920, at the Post Office at Easton, Pa., under the Act of March 3, 1879. Member of the Audit Bureau of Circulations.



G.S. Gearing Takes Terrific Punishment in the ACME Steelstrap Stretcher

ACME STEEL COMPANY specifies G. S. Gearing for the ACME Steelstrap Stretcher. Only Gearing of extreme accuracy and fine quality . . like G. S. Gearing . . can stand up under the gruelling service this sturdy Stretcher gives.

Critical customers from coast-to-coast have learned, through the years, to depend upon us *implicitly* for TOP quality Gearing in each succeeding shipment. Forty years of specializing . . of developing and perfecting men, methods and machines . . has resulted in our mass producing Small Gearing to a degree of UNIFORM accuracy *unapproached in the history of the industry!*

If decidedly better, *more uniformly accurate* Gearing is an important consideration in *your* business, by all means write or call us NOW! Let our capable engineers help you . . preferably while the job is on the boards. Suggestions, ideas, and cost estimates do not obligate you.

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40 Years of Specializing in Small Gearing!

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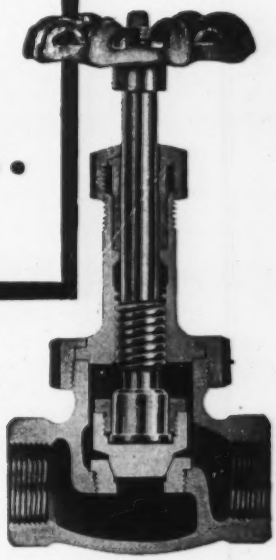
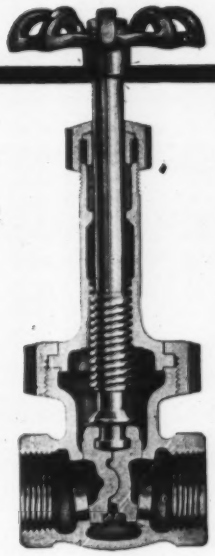
WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

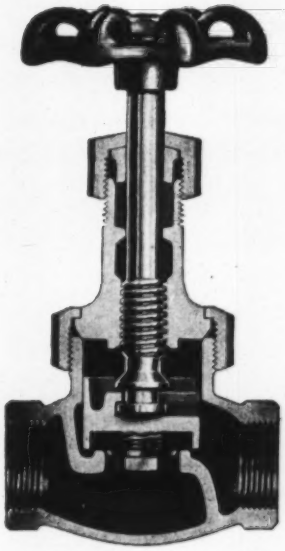
Walworth bronze valves...



Walworth No. 225P Globe Valve
500 Brinell Seat and Disc



Walworth
No. 29 Gate Valve



Walworth No. 95 Globe Valve
Re-New-Disc

built to give dependable trouble-free service on all recommended jobs

Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development—saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bonnets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

Walworth No. 225P Bronze Globe Valves (Angle Type: No. 227P) are rated at 350 psi working steam pressure, 550F; and 1000 psi non-shock service on cold water, oil and gas. The stainless steel, plug type seat and disc — heat treated to 500 Brinell — can be closed on sand, slag, scale and similar floatage, without injury to the seating surfaces. They are the longest wearing, TOUGHEST bronze valves you can buy.

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This 18" O.D. x 3.90" wall, 18" radius chrome moly WeldELL is in power plant service carrying steam at 2000 psi and 1050F.

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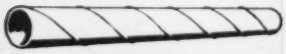
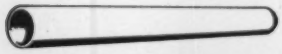
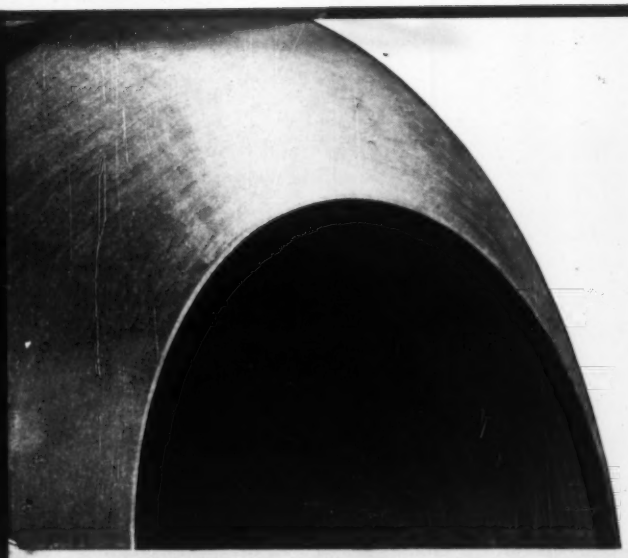

Spiral weld pipe


Large diameter electric weld pipe

Welding necks



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Engineered for accuracy . . . forged for greatest strength and longest life . . . backed by the know-how that has come with 55 years of experience in the forming of metal products by hammering, rolling, extruding, drawing, pressing, welding—in fact, by every known basic metal working process.

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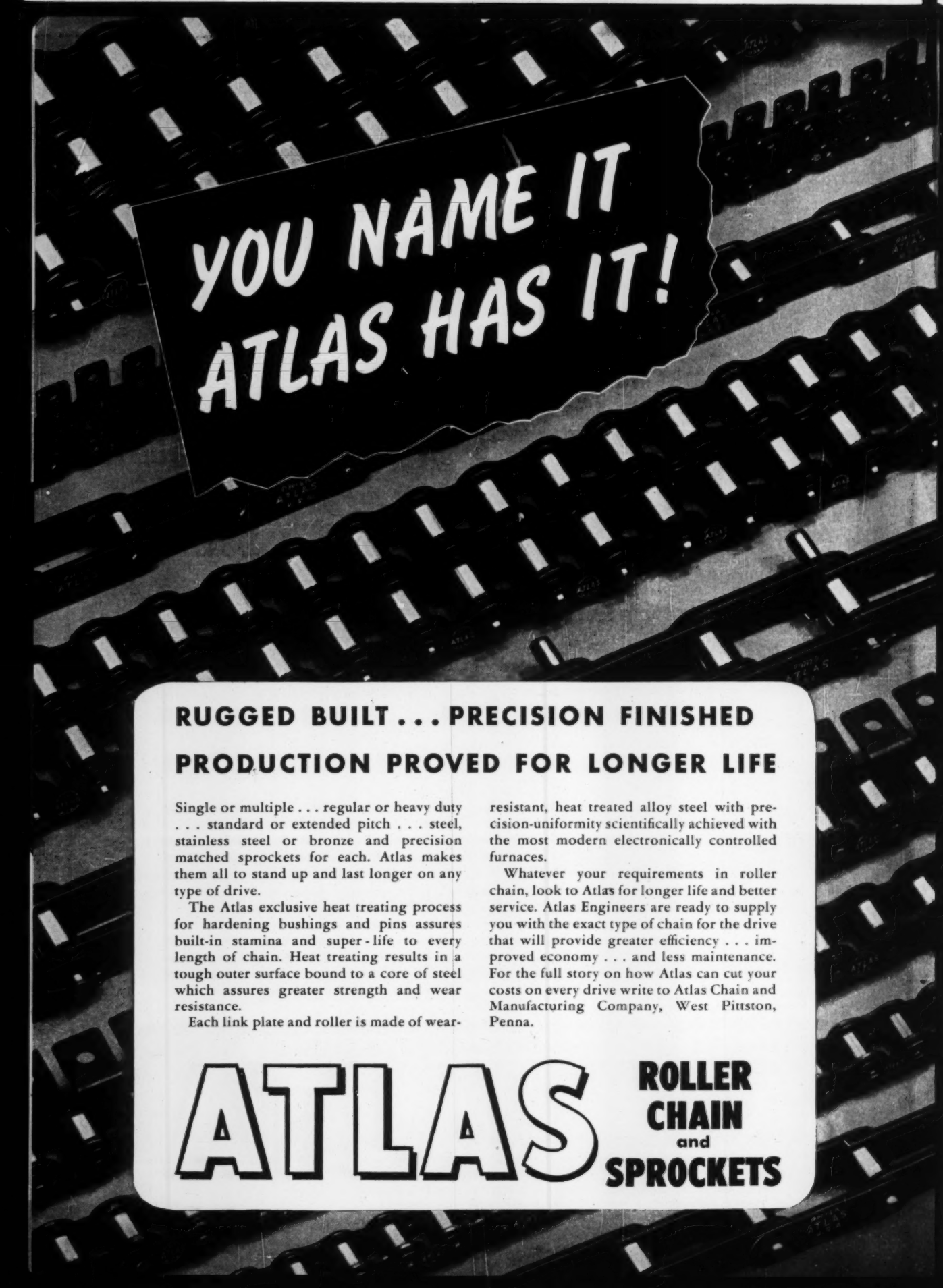

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Single or multiple . . . regular or heavy duty . . . standard or extended pitch . . . steel, stainless steel or bronze and precision matched sprockets for each. Atlas makes them all to stand up and last longer on any type of drive.

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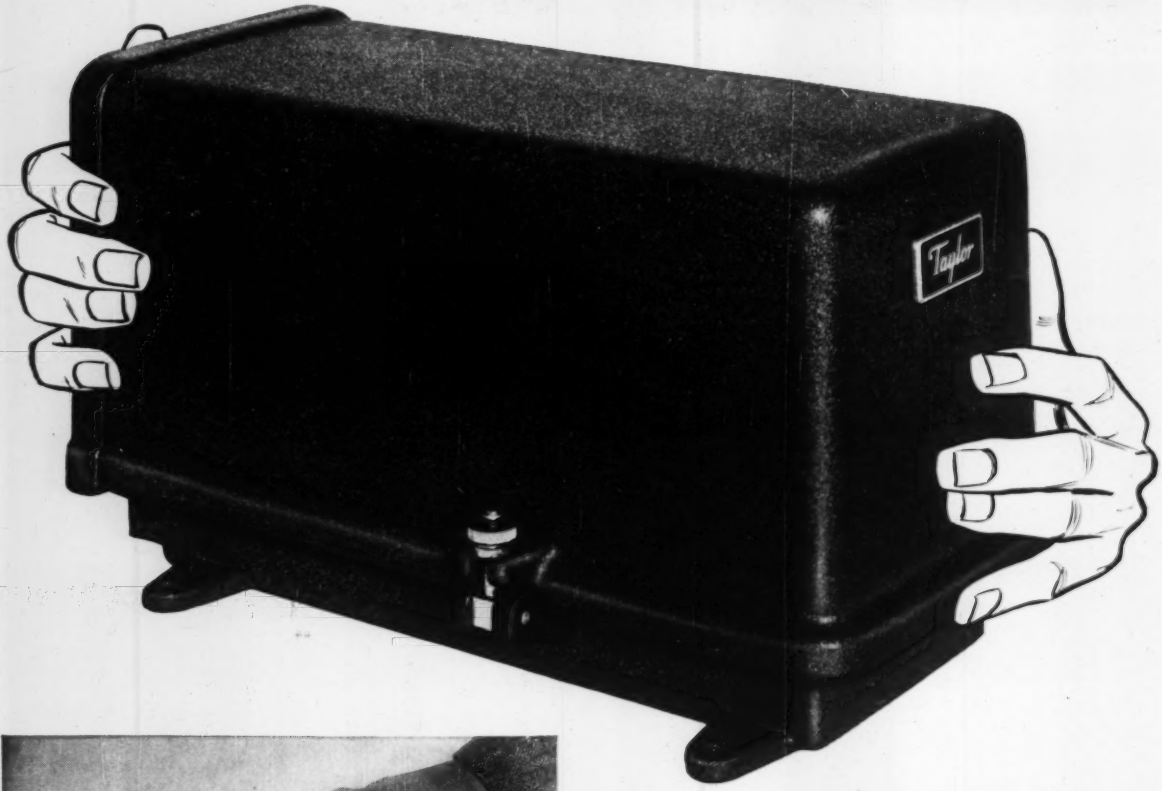
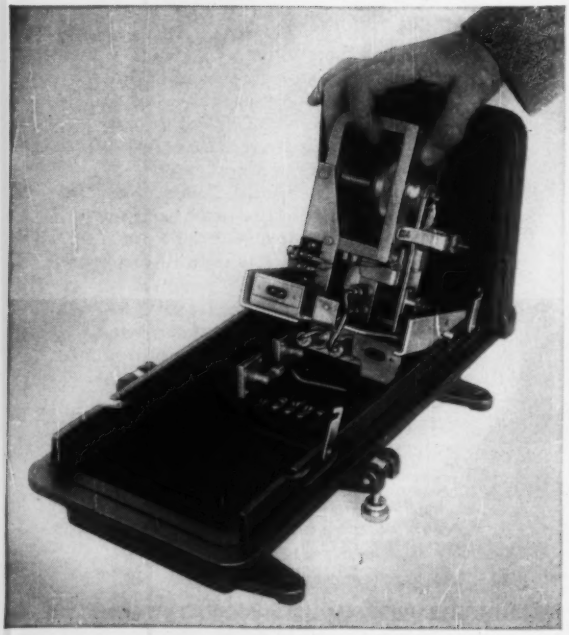
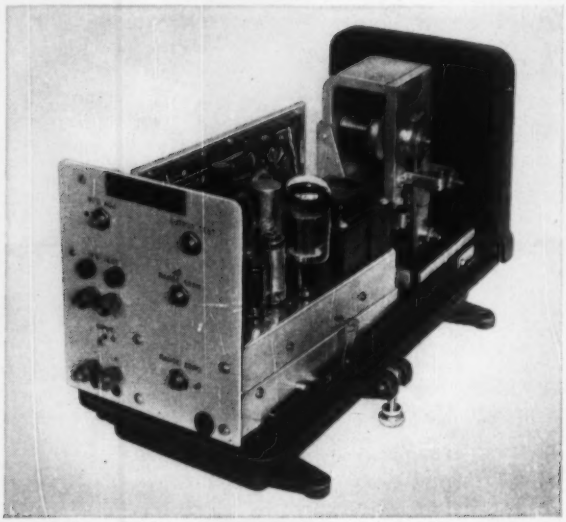




Plugging in the Transducer. This exclusive plug-in feature applies to both the transducer and the amplifier. Means quick, easy removal for service; minimum instrument down-time; checking can be done in the shop where full facilities are available. Also permits separate calibration.



Plugging in the Amplifier. See how easily units are locked into the chassis. Also note screwdriver adjustment of range span and zero suppression by virtue of unique potential dividers. Exclusive Taylor vernier adjustment permits resolution of 1 part in 100,000.

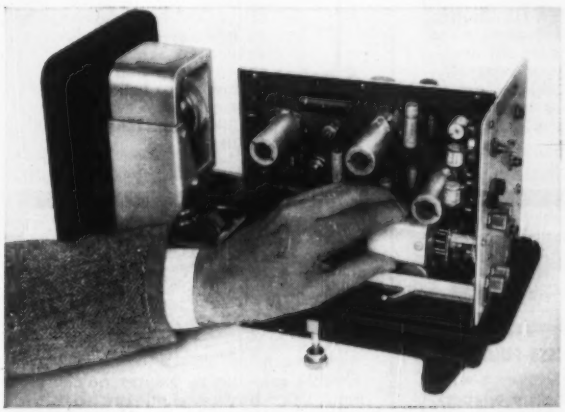
POTENTIOMETER TRANSMITTER

with all the innovations, ruggedness, dependability and versatility that industry expects from Taylor

TAYLOR has broadened its base of measurement with the introduction of an electronic instrument that extends the versatility of its pneumatic controllers and receivers. The TRANSET* Potentiometer Transmitter is a completely adaptable instrument for the measurement of a wide variety of variables, and can be quickly modified for use with different electrical primary elements. This ingenious instrument reflects Taylor's years of experience and knowledge of the requirements of the processing industries.

The TRANSET Potentiometer is especially adaptable where processing conditions require pneumatic controllers and receivers, and where conventional measuring circuits have not proved adequate. In thermocouple applications, for example, it can accurately measure temperatures within limits of minus 320°F. to plus 3272°F., with range spans as short as 100°F., depending upon the characteristics of the thermocouple used.

*Reg. U.S. Pat. Off.



Plugging in the Input Circuit Board. It can be quickly adapted for use with different primary elements by simply plugging in the corresponding input circuit; e.g., for thermocouple applications cold junction compensation is provided in the plug-in circuit board. One instrument can therefore be used as a spare wherever a transmitting potentiometer is used.

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1. The unit is automatically, continuously standardized and offers complete electronic balance, permitting optimum response adjustments. There are no slide wires or motor drive.

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3. Output impedance is virtually infinite. Its 0 - 5 milliamp signal can perform multiple auxiliary functions without affecting accuracy of pneumatic signal.

4. Range span and zero suppression adjustments are easily made by screwdriver due to unique design of high resolution potential dividers.

5. Both electronic and pneumatic units plug-in. Simplifies service; permits separate calibration.

6. Normal load is automatically inserted when amplifier is removed for service.

7. Modern printed circuits insure uniform performance. Test terminals provided for trouble shooting.

8. Three-circuit jack on front panel permits easy monitoring of output current. Convenient pin jacks provided for checking standardization voltage.

9. Three-piece, purged cast-aluminum case is moisture and corrosion proof. All adjustments are readily accessible.

10. If used only for scanning, logging or similar auxiliary functions the instrument is available without transducer.

Write for Bulletin 98262. Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

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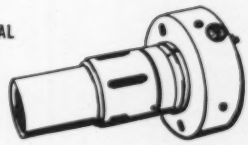
IN HOME AND INDUSTRY

BJ PUMPS DO A BETTER JOB!

Shown here are a few of Byron Jackson's complete line of centrifugal pumps and mechanical seals. For more information or special engineering assistance, contact your nearby BJ sales office or write Byron Jackson Pumps, P.O. Box 2017 Terminal Annex, Los Angeles 54, California.

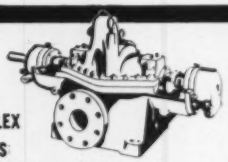
MECHANICAL SEALS



Replace standard packing in stuffingboxes. Eliminate excessive leakage and frequent repacking. Recommended for corrosive, high temperature or volatile liquid pumping. Prevent contamination of pumped liquid.

SUBMERSIBLE PUMPS

For well pumping, booster stations, or for standby service. Pump and sealed motor operate completely submerged. No pump house or surface structure needed. No well too deep. Ideal where flood menace exists. Capacities to 20,000 gpm and heads to 1800 ft. Write for Bulletins 55-2-700 and 55-3-700.

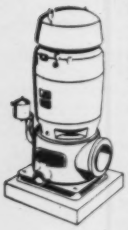


MULTIPLEX PUMPS

Recommended for boiler feed, pipeline, debarking and all classes of medium-to-high capacity, medium-to-high pressure and temperature service. Easy inspection or cleaning without disturbing piping, bearings or driver. Write for Bulletin 52-4000.

MOLTEN METAL PUMPS

These are special pumps for the efficient handling of liquid metals and molten chemicals at temperatures to 1500°F. Handle molten magnesium, sodium, lead, bismuth and other similar liquids.



DEEPWELL TURBINE PUMPS

Capacity and head combination from 3 bowl types and over 100 impeller designs. Choice of oil or water lubrication. Standard models for wells to 24" I.D. "Bee Jay" models for wells of 4", 5" and 6" I.D. Write for Bulletins 54-2-100 and 52-5150.

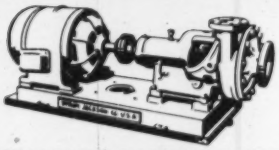


FIGURE 1025-1125 PROCESS PUMPS

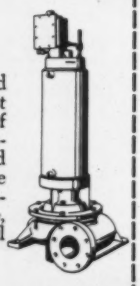
Moderately priced pumps for general-purpose handling. Available with BJ Mechanical Seal. Capacities to 2000 gpm, heads to 800 ft. Temperature limit 350°F. Write for Bulletin 353-300.

HYDROPRESS PUMPS

For medium to high pressure pumping at low capacity. Vertical construction saves space, simplifies installation. No relief valves required. Uniform non-pulsating flow. Capacities to 300 gpm. Heads to 7000 ft. Write for Bulletin 52-6400.

CANNED MOTOR PUMP

A hermetically-sealed pump and motor unit with zero leakage of pumped liquid to atmosphere. Motor, rotor and bearings operate in the pumped liquid. Primarily used for radioactive, toxic or other critical liquids.



MECHANICAL DRIVE SUBMERSIBLE MOTOR

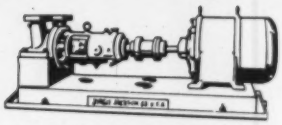
Mechanically-sealed, oil-filled motors in sizes from 7½ HP through 750 HP. From 2-pole operation to 10-pole. All operate on 60 cycle. Operate horizontally or vertically. Explosion-proof. Ideal for use as driver in applications where dust, fumes or flood-out may damage normal motors.

LIQUID OXYGEN PUMP

Specially designed to handle liquid oxygen or nitrogen at temperatures as low as −300°F. An insulated section between pump and stuffingbox keeps leakage to a minimum. Capacities to 300 gpm. Heads to 3000 ft.

SUMPMASTER PUMPS

A complete line of standard vertical sump pumps in more than 3000 combinations. Also recommended for cooling, circulating and booster service. Self-priming. Capacities to 2600 gpm., heads to 300 ft. Write for Bulletin 54-3-1420.

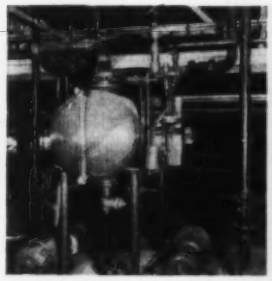


2-STAGE SM PROCESS PUMPS

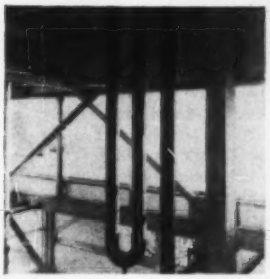
For pumping fluids over a wide range of pressures and for temperatures up to 800°F. Ideal for pumping hot or cold liquids near their boiling point. Capacities to 2200 gpm and heads to 1600 feet. Write for Bulletin 54-1-230.

DOUBLE CASE BOILER FEED PUMPS

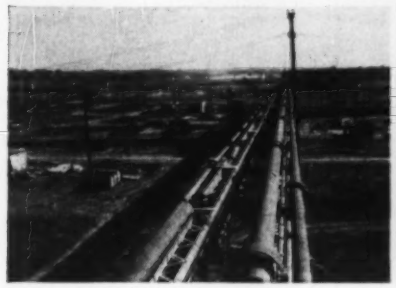
Double-case design assures quick, uniform preheating, eliminates axial and radial thrusts. Horizontally-split inner volute case. Easily dismantled and reassembled. Capacities up to one million pounds per hour. Write for Bulletin 52-4500.



Wrought iron pipe serves condensate pump battery

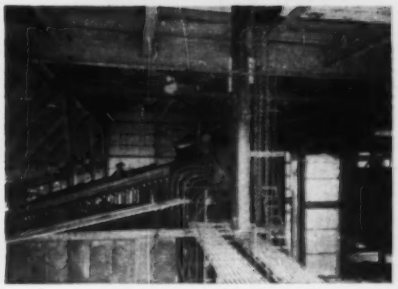


8" wrought iron condensate overflow line in boiler room



Wrought iron steam return on trestle between buildings

Welding elbow on 10" wrought iron condensate line



10" wrought iron condensate lines in boiler room

In its new Appliance Park, GENERAL ELECTRIC assigns WROUGHT IRON PIPE to corrosion "HOT SPOTS"

Quality—a key word in the planning, designing, and manufacturing of General Electric appliances—is also a basic Company consideration in the application of wrought iron in their new Appliance Park, near Louisville, Kentucky. More than 359 tons of this time-tested material was used to safeguard against corrosion in exposed water lines and steam return lines in all of the five buildings in the plant plan.

Architects and Engineers—Fairbrother-Miehls, Detroit, Michigan; Albert Kahn, Associated Architects and Engineers, Inc., Detroit, Michigan.
Consultants—Eggley-Furlow, Philadelphia, Pennsylvania.
General Contractors—Turner-Strock Construction Company.
Plumbing—Standard Engineering, George Blanford, Louisville, Kentucky.
Heating & Piping—Kerby Saunders, New York, New York; Meyer Ward, Louisville, Kentucky.

Our bulletin, *Piping for Permanence*, discusses these, and many other proved wrought iron pipe services. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N.Y. *Available throughout the world.*

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY STEEL PRODUCTS

FORD INSTRUMENT

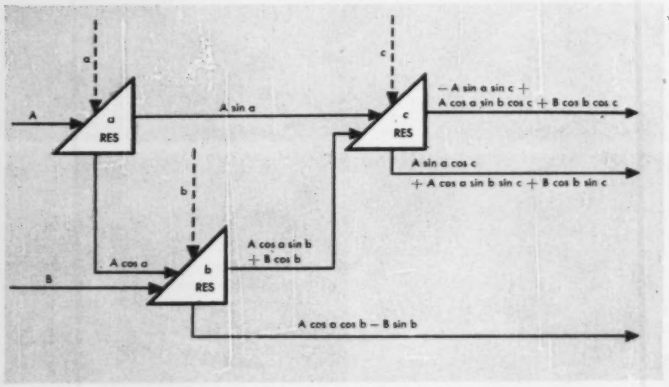
solved one design problem by

CASCADING RESOLVERS WITHOUT ISOLATION AMPLIFIERS

To get around a problem that arises in almost every resolver application Ford engineers recently designed a computer which, among other things, employed a chain of cascaded resolvers to solve complex trigonometric equations, without the use of isolation amplifiers. They solved such an equation as:

$$A \sin a \cos c + A \cos a \sin b \sin c + B \cos b \sin c$$

This was successfully done, without use of vacuum tubes or amplifiers in this circuit:



In view of the widespread use of resolvers to generate sine and cosine functions in modern electro-mechanical analogue computers, it is of great practical significance. Resolvers produced by the Ford Instrument Company have now reached such a high degree of precision, that it is possible to obtain, from an unloaded resolver (which accommodates a single angular quantity only), an accuracy to within less than one tenth of one percent. But most computing circuits call for the use of several resolvers, and once an ordinary resolver is loaded by another resolver, no matter how high its precision, the overall accuracy of the resolver cascade is seriously affected.

The conventional method of avoiding this difficulty is to use an isolation amplifier for each resolver, so that the resolver continues to operate under no-load conditions regardless of the size of the cascade. The importance of cascading without amplifiers is readily appreciated if we realize that the isolation amplifier usually increases the cost of the equipment, more than doubles the size and generates many times more heat that must be dissipated to prevent breakdown of the components. Furthermore, the use of vacuum-tube amplifiers always raises the problem of tube ruggedness and reliability, and requires an additional source of d-c plate voltage.

Have you problems which the engineers at Ford might solve by designing and manufacturing computers, controls or their elements? Write for further information.

85

FORD INSTRUMENT COMPANY

Division of Sperry Rand Corporation

31-10 Thomson Ave., Long Island City 1, N. Y.

Ford's capabilities are among the finest in the country

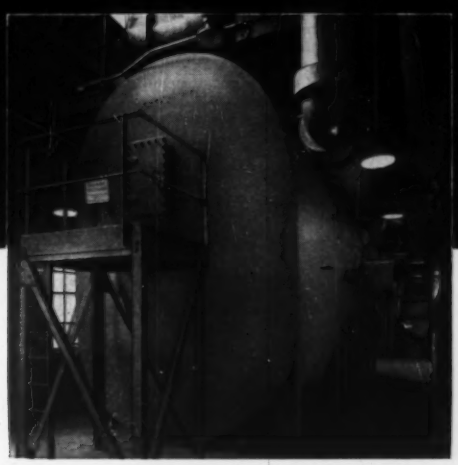
One of the Ford laboratories where a particular design project has called for careful study of resolvers and resolver cascading. Two of the engineers assigned to this project are here checking results. From this work will come one of the new, highly classified weapon systems for the armed forces.

For accuracy and reliability—both vitally necessary in military instruments—experienced machinists must work to fine precision—in the order of .0005 of an inch. Here in one section of the shops of Ford Instrument Company, men are milling parts for an airborne computer.

During the past year Ford Instrument Company has been busy working on many contracts for the U. S. Air Force and the U. S. Navy Bureau of Aeronautics, designing and manufacturing complex computers, controls and their components. For over forty years, Ford Instrument Company has devoted most of its efforts in working for the government to the many problems of weapon controls.

problems in water-conditioning . . .

COMPLETE DEAERATION



Cochrane
Deaerating Efficiency
produces "ZERO OXYGEN!"

The guaranteed completeness and dependability of Cochrane physical deaeration is unsurpassed!

Cochrane pioneered in this field and today has the largest number of deaerator installations in the world. Cochrane's background in deaeration is your assurance that *guarantees will be met!*

Cochrane Corporation designs and manufactures complete lines of deaeration, precipitation, ion exchange and water conditioning equipment. This *complete* service provides single responsibility for engineering, fabrication and continued satisfaction. Consult Cochrane first . . .

For further information on Cochrane Deaerators, write for literature.

COCHRANE DEAERATOR IN A LARGE UTILITY

This giant Cochrane Deaerator, installed in one of the country's largest utilities, has been meeting guarantees for ten years. Special elliptical design was dictated by space limitations. With a capacity of 1,900,000 lbs. per hour, condensate is deaerated to zero (0.005 cc per liter or less) before being fed to high pressure boilers.

COCHRANE CORPORATION · WATER ENGINEERS SINCE 1863 · PHILADELPHIA

Cochrane
CORPORATION

Representatives in 30 principal cities in U.S.; Toronto, Canada; Paris, France; La Spezia, Italy; Mexico City, Mexico; Havana, Cuba; Caracas, Venezuela; San Juan, Puerto Rico; Honolulu, Hawaii.
Pottstown Metal Products Division—Custom built carbon steel and alloy products

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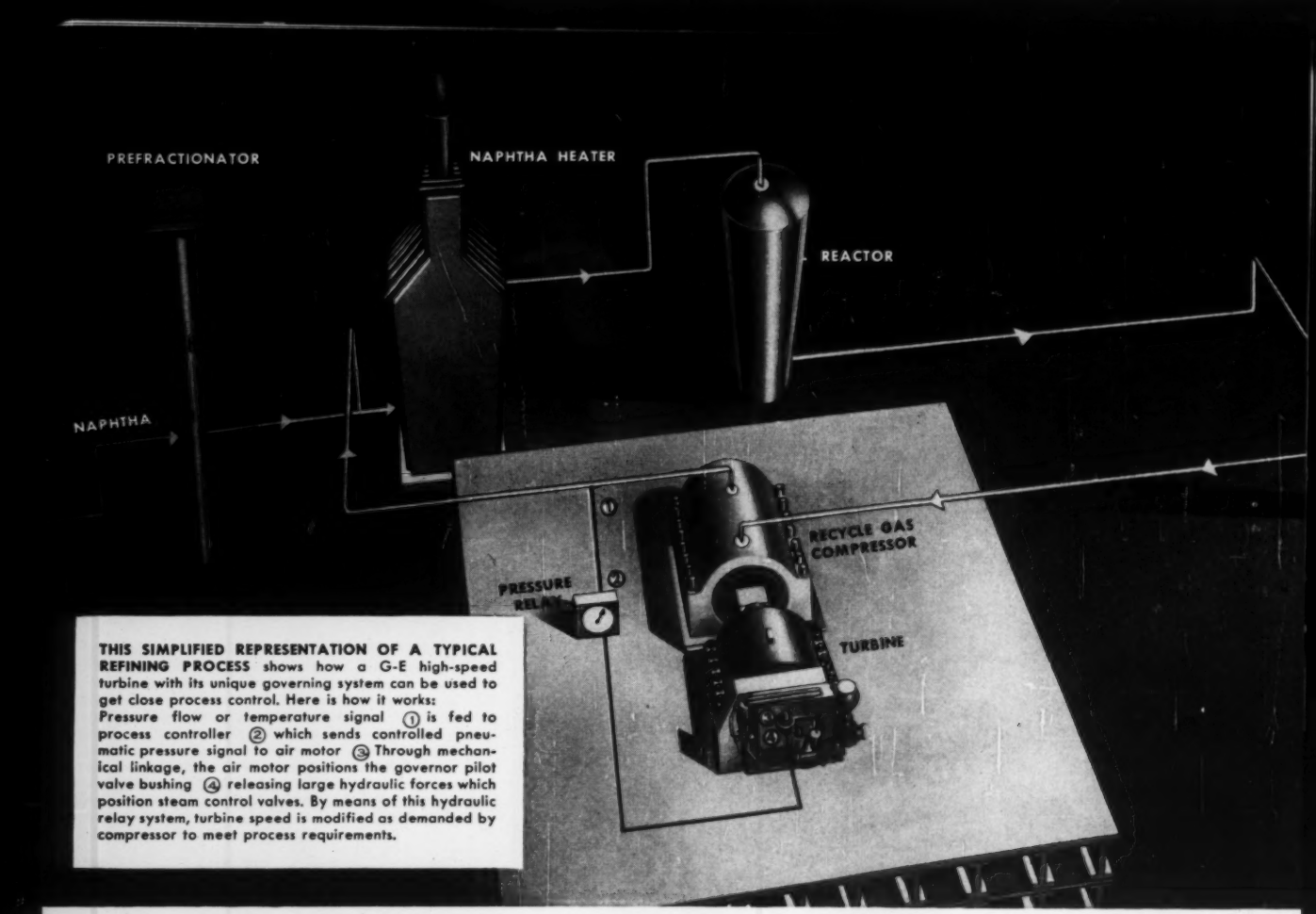
NEW YORK • PHILADELPHIA • CHICAGO

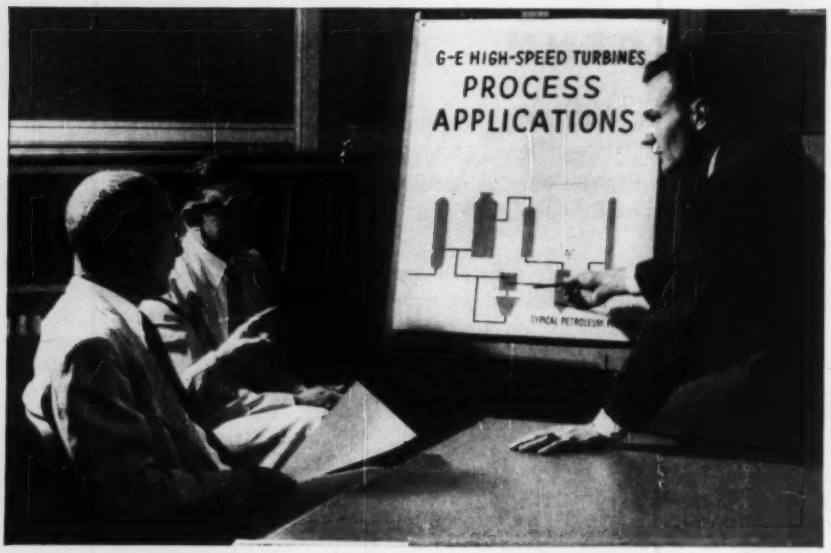
Demineralizers • Hot Process Softeners • Hot Zeolite Softeners • Dealkalizers • Reactors • Deaerators • Continuous Blowoff Systems • Condensate Return Systems • Specialties



THIS SIMPLIFIED REPRESENTATION OF A TYPICAL REFINING PROCESS shows how a G-E high-speed turbine with its unique governing system can be used to get close process control. Here is how it works: Pressure flow or temperature signal ① is fed to process controller ② which sends controlled pneumatic pressure signal to air motor ③. Through mechanical linkage, the air motor positions the governor pilot valve bushing ④ releasing large hydraulic forces which position steam control valves. By means of this hydraulic relay system, turbine speed is modified as demanded by compressor to meet process requirements.

EASILY INCORPORATED INTO YOUR PRESENT SYSTEM . . .

G-E position-restored turbine governing

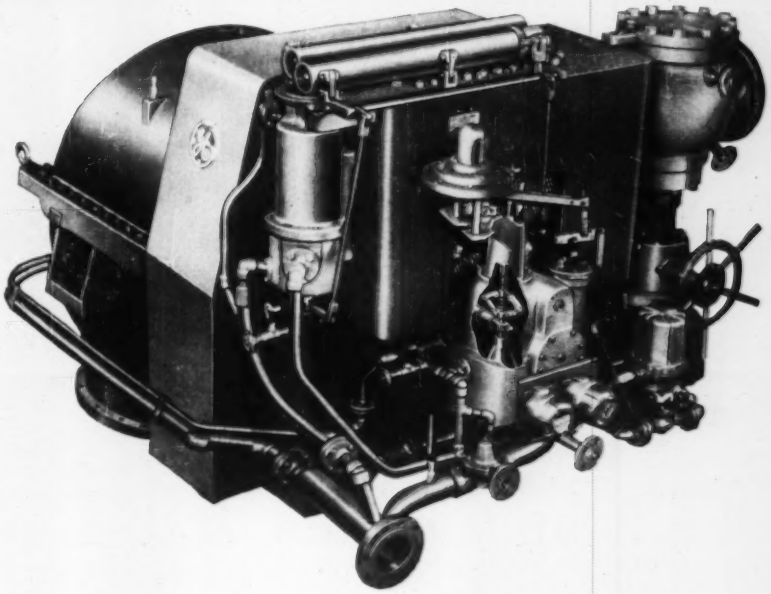


HERE IS THE SMALL TURBINE AND SUPERCHARGER DEPARTMENT MARKETING TEAM that can show you how to apply all the advantages of G-E high-speed turbine governing to your process operations. R. E. Donnelly, Manager—Marketing, discusses a possible petroleum application with H. J. Chase, Manager—Engineering, at left, and C. B. Seelig Manager—Sales, center.

HIGH-SPEED TURBINES FOR ALL PROCESS APPLICATIONS

- PETROLEUM
- CHEMICAL
- PETROCHEMICAL
- STEEL

TURBINES FOR HIGH-SPEED COMPRESSORS...



THE GENERAL ELECTRIC POSITION-RESTORED GOVERNOR, shown cutaway above, utilizes the best features of both mechanical and hydraulic control. Heart of the system is a fly-ball-positioned, rotating pilot valve, which releases a tremendous store of power to position the steam inlet valves. The released power is controlled through feedback by a weight-biased mechanical-linkage that repositions the pilot-valve bushing only in direct response to movement of the steam-inlet valves, rather than in response to a force generated by the movement of the valves.

can give you close process control

In process industries, if quality-control and peak production are to be maintained, turbines that drive high-speed compressors and blowers must have close, accurate governing in response to load requirement and the slightest variations in steam conditions.

To help you get more precise control, all G-E high-speed turbines have a position-restored governor. It is an oil-relayed, mechanical-type control device that automatically matches turbine speed to process demands.

This governor will operate accurately and effectively with any recycle controlling system because the mechanical-linkage can be adjusted to match the complete output-signal range of any process controller. The G-E governor can be incorporated with a typical control system as shown in the schematic drawing.

FOR CLOSE PROCESS CONTROL the unique design of the G-E high-speed turbine governor offers these advantages:

Accurate signal relay results since speed changes are made through a weight-biased mechanical-linkage which repositions the pilot valve bushing only in direct response to movement of the steam-inlet valve. The system is not affected by oil-flow forces and is quick to respond to changes in process requirements.

Direct, precise speed settings are therefore possible because turbine response to process requirements is not dependent on force balance between springs and signal pressure.

Completely integrated governing responds not only to process demand but also to steam pressure or temperature changes, which must be factored in for close process control.

Position-restored governing keeps the system in near-perfect equilibrium, practically eliminating speed surges and turbine "hunting." Be sure to see how this governing system may be used to advantage in your process operation.

For more detailed information, contact your nearest General Electric Apparatus Sales Office or write General Electric Company, Schenectady 5, N. Y. In Canada, contact Canadian General Electric Company, Limited, Toronto. 241-3

Progress Is Our Most Important Product

GENERAL ELECTRIC

Change motors in minutes—

with FALK *all-steel* MOTOREDUCERS

No long and costly "down time" involved

Motors can be interchanged or replaced *in minutes* with the all-steel, All-Motor type FALK Motoreducer. No long and costly "down time" is involved in making the change!

Best of all, replacement is not limited to original make of motor—new NEMA frames may be substituted for old. This versatile Motoreducer operates with any make, speed or type of standard foot-mounted motor within its AGMA rating. No modification, no special shaft, no "partial" motor required.

In addition to unmatched motor interchangeability, this dependable gear drive—the "work horse of industry"—offers: widest choice of output-shaft position (horizontal, vertical, right-angle)...any output-shaft connection...any mounting, including wall and ceiling...standard speed range from 1.5 rpm to 1430 rpm. All these advantages, plus proved efficiency, low maintenance and extra-long life, make the All-Motor type FALK Motoreducer your best buy for any job requirement.

Furnished in sizes up to 75 hp with any make, style or type of motor; or, *without a motor if desired.* FALK Motoreducers are available from convenient factory, field or distributor stocks, from coast to coast.

Write for Bulletin 3100

THE FALK CORPORATION, MILWAUKEE, WISCONSIN

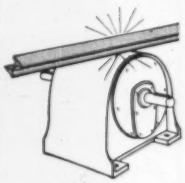
MANUFACTURERS OF:

- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining

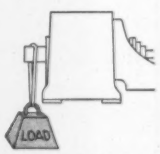
FALK

...a good name in industry

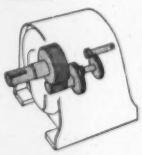
FALK "IN-BUILT" FACTORS assure full dependability—better service—longer life



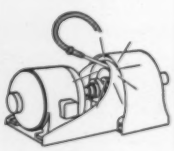
ALL-STEEL HOUSINGS
Rugged, strong, rigid ...all parts heavy steel plate, formed and welded in the Falk Weld Shop.



LARGE OVERHUNG LOAD CAPACITY
Large shafts, oversize bearings...rigid mountings with wide bearing spans to handle maximum loads.

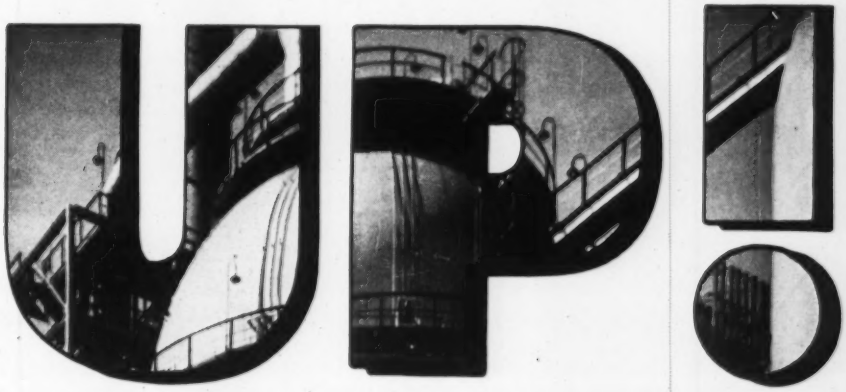


PRECISION GEARING
Heat-treated alloy steel gearing, precision cut and shaved after heat treatment to eliminate distortion.



SEALED HOUSINGS
Splashproof, dustproof, oiltight. Dual closures and one-way vents keep oil in, dust and moisture out.

HOW TO KEEP PRODUCTION UP!



A few generations ago, John Ruskin had a few penetrating remarks to register on business—and what he said makes a lot of sense today.

"The common law of business practice," he commented, "prohibits paying a little and getting a lot. If you deal with the lowest bidder, it's well to add something for the risk you run. And if you do that, you will have enough left over for something better."

Let's translate this in terms of furnace construction for refineries. If you buy a heat enclosure for a job where high and continuous production is a must, then it's imperative that you invest in one that will stand the gaff. To make sure, you've got to build a unit which is properly engineered for the job it must do. You pay more, of course. But it's poor economy—and often embarrassing—to plow money back into repairs right at the peak of production.

That's all we have to say. You get sound engineering and a job designed to stay on stream when you come to Bigelow-Liptak. We've been designing refinery furnaces for years—erecting them, too. Both suspended and castable construction—the one that's best for the job—are used. Better investigate—right now!

FIRST COST OF AN INFERIOR JOB

PLUS REPAIRS AND LOST PRODUCTION

FIRST COST OF A BIGELOW-LIPTAK JOB

4398

BIGELOW-LIPTAK *Corporation*

AND BIGELOW-LIPTAK EXPORT CORPORATION
2550 WEST GRAND BOULEVARD, DETROIT 8, MICHIGAN

UNIT-SUSPENDED WALLS AND ARCHES

In Canada: BIGELOW-LIPTAK OF CANADA, LTD., *Toronto, Ontario*

ATLANTA • BOSTON • BUFFALO • CHICAGO • CLEVELAND • DENVER • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MINNEAPOLIS • NEW YORK
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Depend on LADISH

- Carbon Steels
- Carbon-Molybdenum Steels
- Chromium-Molybdenum Steels
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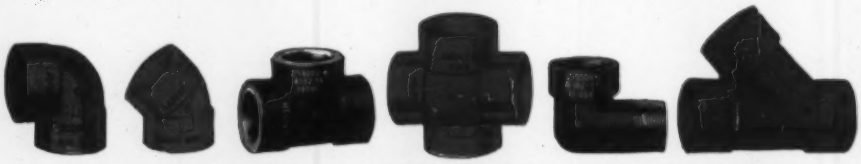
- Chromium-Silicon-Molybdenum
- Wrought Iron
- Chromium Type Stainless
- Chromium-Nickel Stainless
- Molybdenum Type Stainless
- Wrought Aluminum
- Aluminum-Copper Alloys

BUTT WELDING FITTINGS

½ inch through 42 inches . . .

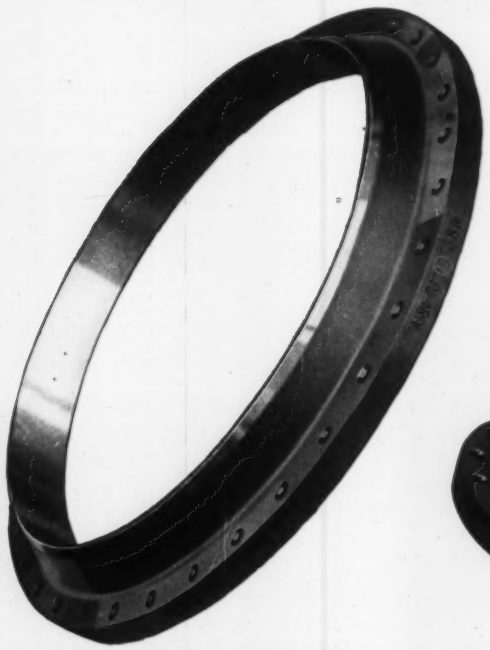
FORGED CORROSION RESISTANT—LIGHT WEIGHT and A.S.A. FLANGES

½ inch through 24 inches . . .



FORGED SCREWED OR SOCKET WELDING FITTINGS and UNIONS

⅛ inch through 4 inches . . .



LARGE DIAMETER AND T.E.M.A.* STANDARD FLANGES up to 20 feet O.D.

*Tubular Exchanger Manufacturers Association

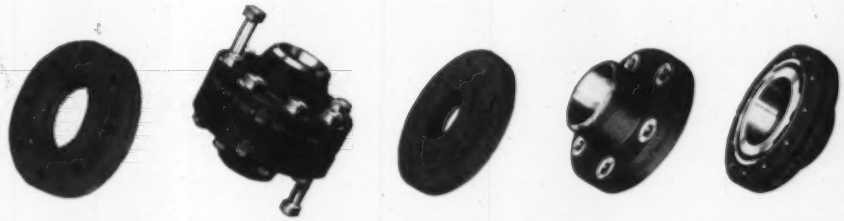
LONG WELDING NECKS

up to 24 inches, 150 lb. through 2500 lb.

Complete Service . . .

BUTT WELDING FITTINGS

Schedules 5S, 10S, 40S, 80S, and other Schedules and wall thickness.



FORGED CORROSION RESISTANT—LIGHT WEIGHT and A.S.A. FLANGES

150 lb. through 2500 lb. pressure ratings.

FORGED SCREWED OR SOCKET WELDING FITTINGS and UNIONS

150 lb. Corrosion Resistant and 2000 lb. through 6000 lb. ratings.

FOR FITTINGS FROM ANY FORGEABLE MATERIAL TO MEET YOUR SERVICE REQUIREMENTS

You get prompt, efficient service when you specify and order from the complete Ladish Controlled Quality line. Fittings *in any forgeable material* in virtually every type, size, wall thickness or pressure rating . . . are produced to one uncompromising Controlled Quality standard . . . and identified with heat code symbols pioneered by Ladish as verification of metallurgical integrity resulting from exhaustive tests made in the Ladish metallurgical laboratories.

For *complete service* on your fittings requirements, depend on the Ladish line and the services of your Authorized Ladish Distributor.

THE COMPLETE *Controlled Quality* FITTINGS LINE

LADISH CO.

CUDAHY, WISCONSIN

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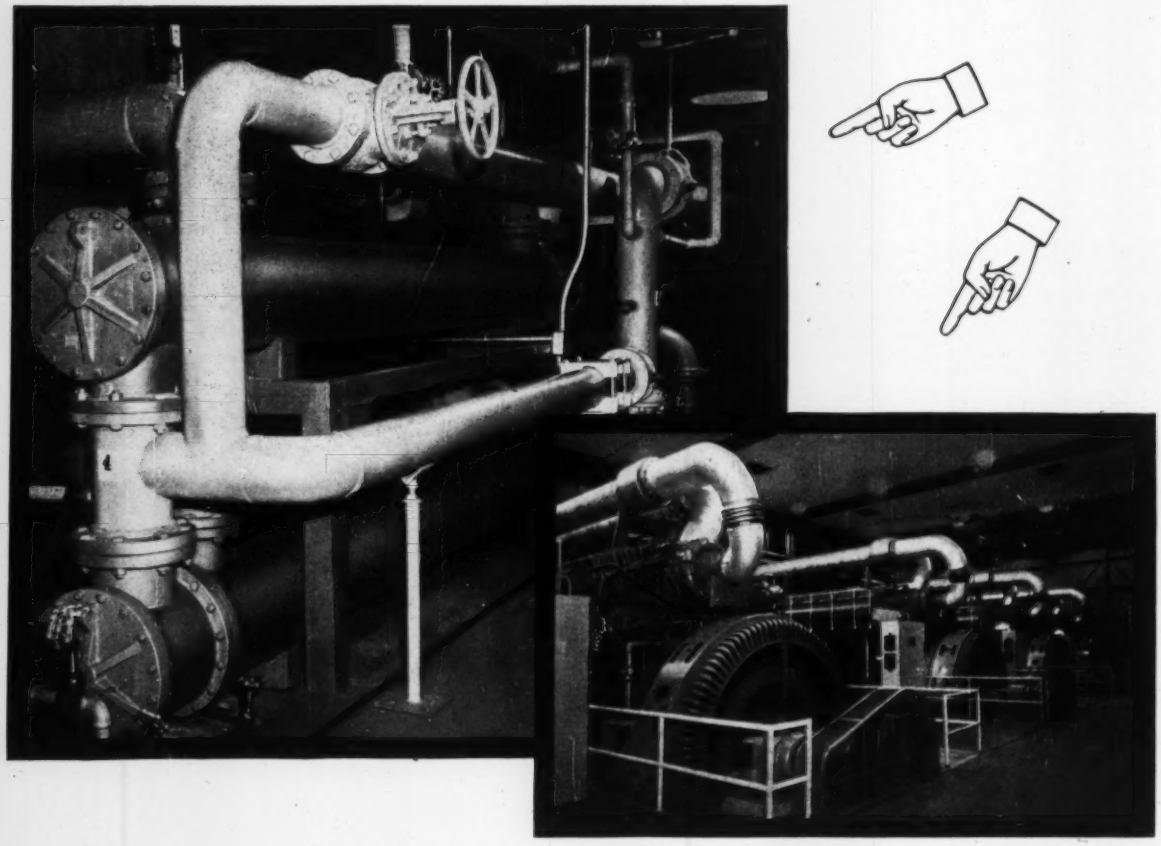
- Aluminum-Manganese Alloys
- Deoxidized Copper
- Hastelloy
- Titanium
- Forging Brass
- Everdur Bronze
- Silicon Bronze
- Manganese Bronze
- Wrought Nickel
- Nickel-Copper Alloys
- Inconel
- Monel

ROSS EXCHANGERS on winning team with Cooper-Bessemer Engines in REA plant contest



Recent winner of the Efficiency Award for "the nation's best operated internal combustion REA plant of the year," the M & A Electric Power Cooperative at Poplar Bluff, Mo., rode to victory with a top flight combination of Cooper-Bessemer Engines and Ross Exchangers. Its four 3300 hp Cooper-Bessemer "three-way" engines carried an overload of as much as 18 hours every weekday, month after month, to produce 58,945,000 kw/hrs.

To maintain prescribed lube oil and jacket water temperatures, two Ross Exchangers were furnished with each engine. Dependable cooling was assured from the start. So, too, was fuel oil heating: One Ross Exchanger handles this key job for all four engines.

In major power plants and industries . . . in oil fields as well as aboard harbor tugs and ocean liners, you'll find Ross Exchangers teamed with practically all types of Diesel, gas and gasoline engines.

Favored by engine builders and users alike for their extreme ruggedness and high thermal efficiency, Ross Exchangers are pre-engineered, fully standardized and promptly available in a wide range of designs and sizes.

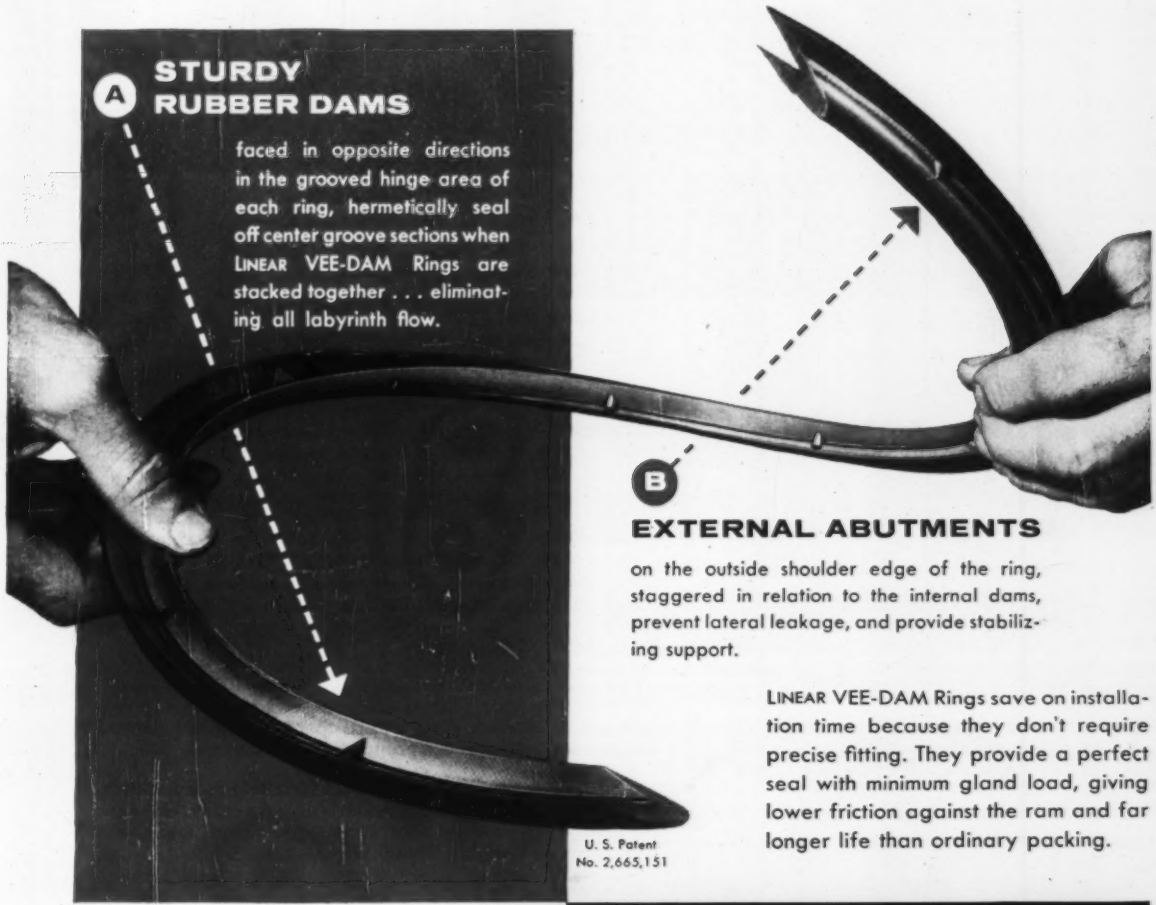
For detailed information, request Bulletins 2.1K5 (coolers) and 1.4K1 (heaters).

ROSS HEAT EXCHANGER DIVISION
of
American - Standard
1448 WEST AVE. • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

At last!
SPLIT V-RING PACKING
that's really LEAKPROOF!

LINEAR VEE-DAM RINGS

Labyrinth flow and lateral leakage are stopped by LINEAR'S uniquely designed, revolutionary VEE-DAM RINGS. Installation of these trouble-saving, long-lasting packings is virtually foolproof!



A STURDY RUBBER DAMS

faced in opposite directions in the grooved hinge area of each ring, hermetically seal off center groove sections when LINEAR VEE-DAM Rings are stacked together . . . eliminating all labyrinth flow.

U. S. Patent No. 2,665,151

B EXTERNAL ABUTMENTS

on the outside shoulder edge of the ring, staggered in relation to the internal dams, prevent lateral leakage, and provide stabilizing support.

LINEAR VEE-DAM Rings save on installation time because they don't require precise fitting. They provide a perfect seal with minimum gland load, giving lower friction against the ram and far longer life than ordinary packing.

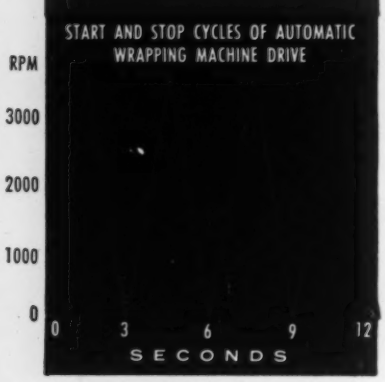
Write or call for complete information on LINEAR *VEE-DAM Rings in a choice of rugged, fabric-reinforced synthetic elastomers, tailored to your requirements.*

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

20 ROLLS OF "SARAN WRAP" EVERY MINUTE



The Dow Chemical Company's production of "Saran Wrap" has leaped from 130,000 rolls to 4,000,000 rolls a month since 1951. This up-swing is due to a new plant, a new flow system, and additional equipment including new machinery equipped with Reliance V★S Drives.

One of the most dramatic applications of V★S Drives is on the final wrapping machines shown here. The drives must be able to start, accelerate to 3500 rpm., and stop more than 20 times a minute.

The most important feature, though, is not the frequent starts and stops, but the delicately controlled acceleration of the drives. "Saran Wrap" is only 1/6th as thick as a human hair, and sharp or jerky starts will cause a break in the sheet and halt production. Reliance Drives do the job day in and day out without a single break due to uncontrolled acceleration.

This feature of V★S Drives, called *Dynamic Response*, is only one of the many facets of Reliance Drives. V★S Drives can regulate tension, synchronize operations, control speed rates, and automatically program speed changes.

Whether you handle a thin film of plastic or steel billets, on a complete production line or a single machine, Reliance can give you better quality, more production, and lower costs through Variable Speed Drives. D-1506

RELIANCE V★S DRIVE ®

Write for bulletin D-2311.

RELIANCE ELECTRIC AND ENGINEERING CO.

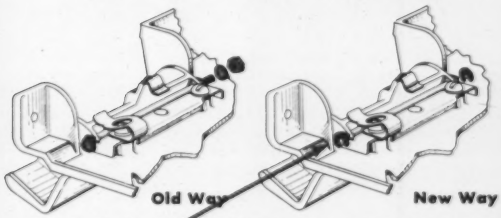
CLEVELAND 10, OHIO • OFFICES IN PRINCIPAL CITIES
Canadian Division: Welland, Ontario

5 Waldes Truarc rings eliminate parts, speed assembly, in light, compact dictating machine

Edison's "V. P." Voicewriter

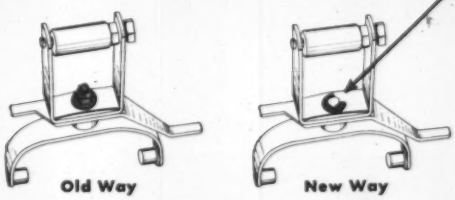
Edison engineers built this new dictating instrument for small size, light weight, and rugged performance. Waldes Truarc rings replace old fashioned fasteners, cut production costs; keep unit light, compact, and achieve faster more economical assembly.

Disc Lever Cover Assembly



Two Waldes Truarc E-Rings (Series 5133) replace nut, bolt, washer assembly, eliminate one component and assure precise alignment of parts. Truarc rings facilitate pivoting without binding. Production assembly time is decreased.

Lift Bracket and Fork Assembly



A single, easily assembled Waldes Truarc E-Ring (Series 5133) replaces nut-bolt-washer fastening. Free pivoting is assured, one component eliminated, labor and material costs reduced.

Clutch Plate Assembly

Two Truarc E-Rings eliminate staking operation, prevent damage to spring coil. Simple assembly operation speeds production, eliminates rejects, reduces labor and material costs.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today. Let our Truarc engineers help you solve design, assembly and production problems, without obligation.

For precision internal grooving and undercutting ... Waldes Truarc Grooving Tool!

WALDES TRUARC® RETAINING RINGS

Send for new catalog supplement

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
(Please print)

Name.....
Title.....
Company.....
Business Address.....
City..... *Zone*..... *State*.....

ME 018

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

Pumping Progress Report

FOR MECHANICAL ENGINEERS

An advertisement prepared by the Aldrich Pump Co., Member of Hydraulic Institute, U.S.A.

THE USE OF FLAMMABLE OIL as a hydraulic medium has two major objections — cost and the ever-present danger of fire. Providing a system that would overcome these objections was the problem presented to Aldrich Engineers by a manufacturer of die-cast parts for the automotive industry.

MAKE-UP OIL COST, for this manufacturer, was almost unbelievably high. The fire risk was great. Despite the best efforts of safety control, flash fires were inevitable.

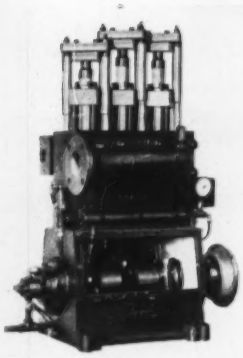
ONE SOLUTION was to pump water as the hydraulic fluid. But the manufacturer knew from experience that an ordinary pump couldn't do this job. What would we recommend?

WATER AS THE HYDRAULIC MEDIUM was our answer. And because Aldrich Direct Flow Pumps can pump water successfully, this manufacturer now operates a low cost, fire-free central hydraulic system. This die-caster gained other advantages by changing to his Aldrich-engineered central system. Aldrich Direct Flow Pumps feature fluid-end sectionalization, with a greater economy of maintenance and repair than was previously possible, horizontal valve action, parts standardization and simplicity of construction.

ALDRICH ENGINEERS will gladly consult with you on any pumping problem. Data Sheets describing the Aldrich series of Direct Flow Pumps will be sent to you on request. Ask for Data Sheet

63 — 2½" Stroke, 25 hp. Triplex
64A — 3" Stroke, 50 hp. Triplex
64, 64B — 5" Stroke, 100 to 200 hp. Series
67A — 6" Stroke, 300 to 900 hp. Series

Address your request to: The Aldrich Pump Company, 29 Pine Street, Allentown, Pa.



2½" Stroke, Triplex "POWR-PAC" Pump

...for your tough pumping problems specify ALDRICH

Solving tough pumping problems has become a specialty with Aldrich. Today, manufacturing plants from coast to coast are performing routine pumping assignments around the clock that were once real headaches for project and plant engineers.

Aldrich Direct Flow Pumps, the basis for solving most of these problems, feature design innovations that provide economies of operation, maintenance and repair in addition to performing jobs not possible with ordinary pumps. If you have a pumping problem, pass it on to us.

TYPICAL METAL WORKING APPLICATIONS FOR ALDRICH PUMPS:

Descaling — Die Casting
Roll Balancing — Press Operation
Hydraulic Testing

Write today for Data Sheets describing the Direct Flow Pump Series.

THE ALDRICH PUMP COMPANY

Originators of the Direct Flow Pump
29 PINE STREET
ALLENTOWN, PA.
Representatives in principal cities

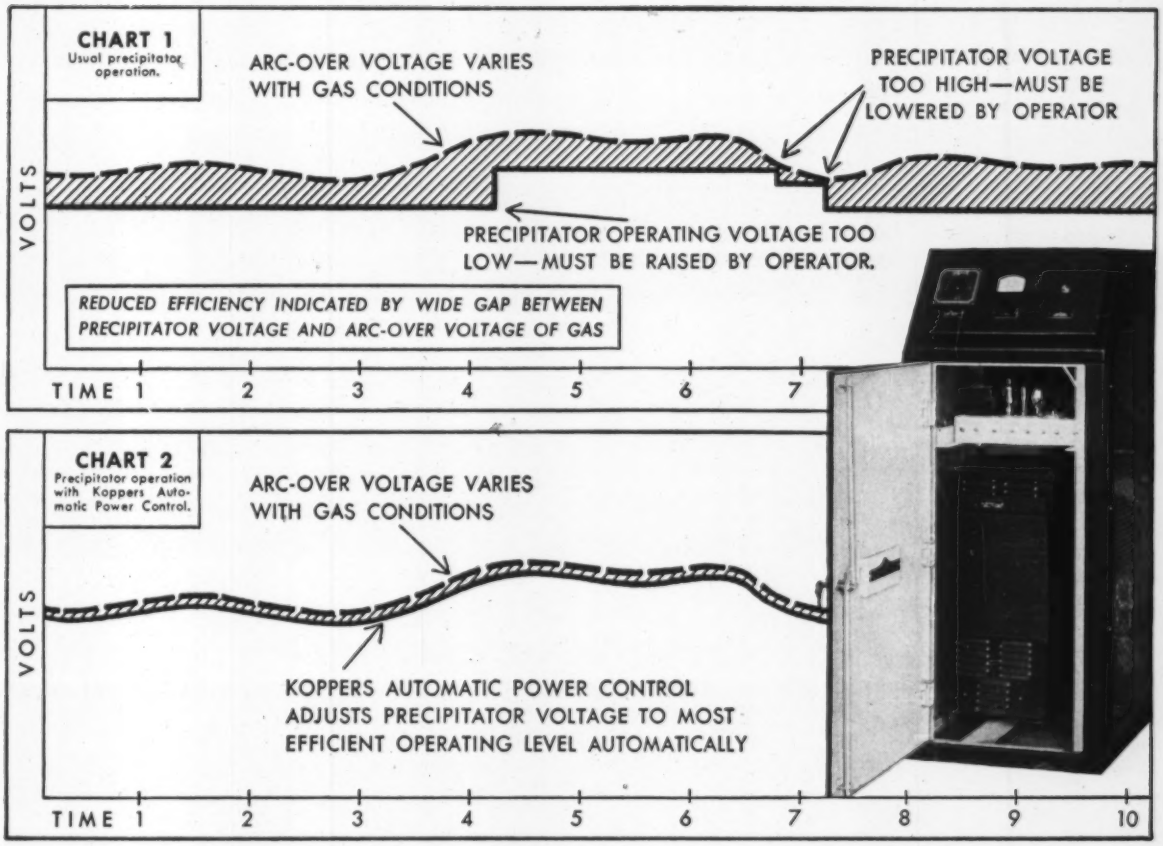


CHART 1
Usual precipitator operation.
ARC-OVER VOLTAGE VARIES WITH GAS CONDITIONS
PRECIPITATOR VOLTAGE TOO HIGH—MUST BE LOWERED BY OPERATOR
VOLTS
PRECIPITATOR OPERATING VOLTAGE TOO LOW—MUST BE RAISED BY OPERATOR.
REDUCED EFFICIENCY INDICATED BY WIDE GAP BETWEEN PRECIPITATOR VOLTAGE AND ARC-OVER VOLTAGE OF GAS
TIME 1 2 3 4 5 6 7
CHART 2
Precipitator operation with Koppers Automatic Power Control.
ARC-OVER VOLTAGE VARIES WITH GAS CONDITIONS
VOLTS
KOPPERS AUTOMATIC POWER CONTROL ADJUSTS PRECIPITATOR VOLTAGE TO MOST EFFICIENT OPERATING LEVEL AUTOMATICALLY
TIME 1 2 3 4 5 6 7 8 9 10

New Koppers Power Control automatically insures maximum Electrostatic Precipitator efficiency

Now Koppers enables you to get *peak* gas cleaning efficiency from your electrostatic precipitator at a minimum of operating maintenance—with the new Koppers Automatic Power Control.

This compact, cabinet unit utilizes electronic controls to automatically maintain the proper voltage to best ionize the gas. As gas conditions vary —an occurrence even under the most constant industrial operations—it automatically adjusts the voltages to the most efficient level for solids removal. This reduces wasteful "sparkover" and enables the precipitator to operate continually at peak efficiency voltage without frequent "trip-outs."

What is more, the new Koppers Automatic Power Control eliminates the need for constant personal attendance. Completely self-contained, easy to install, it quickly repays initial cost with savings in man-hours and operating efficiency.

The new Koppers Automatic Power Control is another engineering advance in a series that has won industry-wide confidence for Koppers Electrostatic Precipitators. Keep Koppers' ability to serve *you* in mind. For information or assistance in solving your gas cleaning problem, send this coupon.

KOPPERS®

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • BALTIMORE 3, MD. This Koppers Division also supplies industry with Fast's Couplings, American Hammered Industrial Piston and Sealing Rings, Aeromaster Fans, Gas Apparatus.

Engineered Products Sold with Service

ELECTROSTATIC PRECIPITATORS

KOPPERS COMPANY, INC., *Electrostatic Precipitator* Dept., 261 Scott St., Baltimore 3, Md.

☐ I am interested in how the new Koppers Electrostatic Precipitator Automatic Power Control can help me to more efficiency and greater savings in gas cleaning.

☐ I am interested in an analysis and recommendations for my operation. I understand I am under no obligation.

Name.....

Address.....

City.....Zone.....State.....

Wickes Boilers selected by one of America's newest, most up-to-the-minute automotive parts and accessories plants

WICKES

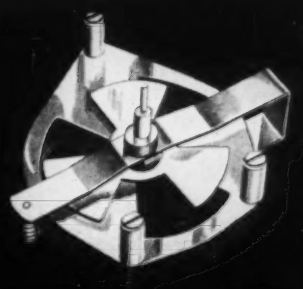
These two Wickes steam generators were installed recently in one of America's most modern automotive parts plants. Each delivers 66,000 lbs. of steam per hour, has a boiler and water wall heating surface of 7340 sq. ft. and an air pre-heater of 5225 sq. ft. Design pressure is 200 psi, operating pressure 150 psi, and water feed temperature 225°F. In factories, institutions, municipal buildings, refineries, processing plants, and many other installations throughout the country, Wickes boilers are supplying dependable, low-cost heat and power. Wickes builds water tube steam generators in a great variety of types and sizes to fill the individual needs of any application. If you are building new facilities, or wish to replace your present steam generator with a newer, more efficient one, contact Wickes. We will be pleased to send you our new 24 page bulletin No. 55-1 containing complete information on Wickes steam generators and fabrication facilities.

THE WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854 • **SALES OFFICES:** Albuquerque, N. M. • Boston • Buffalo • Charlotte, N. C. • Chicago • Cleveland • Dallas • Denver • Detroit • Fort Wayne, Ind. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tulsa • Washington, D. C.

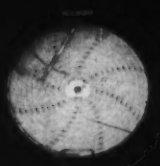
160



In DYNALOG Instruments, a simple, radio-type, variable capacitor replaces the troublesome slidewire – gives unmatched smoothness of balancing.

this potentiometer has no slidewire

STEPLESS CAPACITY-BALANCING PROVIDES SPEED WITHOUT WEAR!



Friction-free balancing action! That's why Dynalog responds almost instantly to the slightest changes in a process variable . . . without wear . . . with *lasting* high accuracy.

The DYNALOG has no fast-moving parts . . . and no gears, cables, or complicated mechanisms to slow response. Sensitivity isn't limited by slidewire windings. A simple, variable capacitor and positive magnetic drive provide continuous, stepless balancing with a sensitivity of 1/100 of 1% . . . an accuracy of ¼ of 1%. And DYNALOG is never "off process" for standardizing — it requires *none*. There are no batteries to replace . . . no motors to periodically clean and lubricate. Only five moving parts!

DYNALOG Instruments can be used with resistance, voltage, capacity, or inductive type primary elements to measure and/or control any process variable with unmatched speed and accuracy. Write for Bulletin 427. The Foxboro Company, 961 Neponset Ave., Foxboro, Mass., U.S.A.

*Reg. U.S. Pat. Off.

FOXBORO

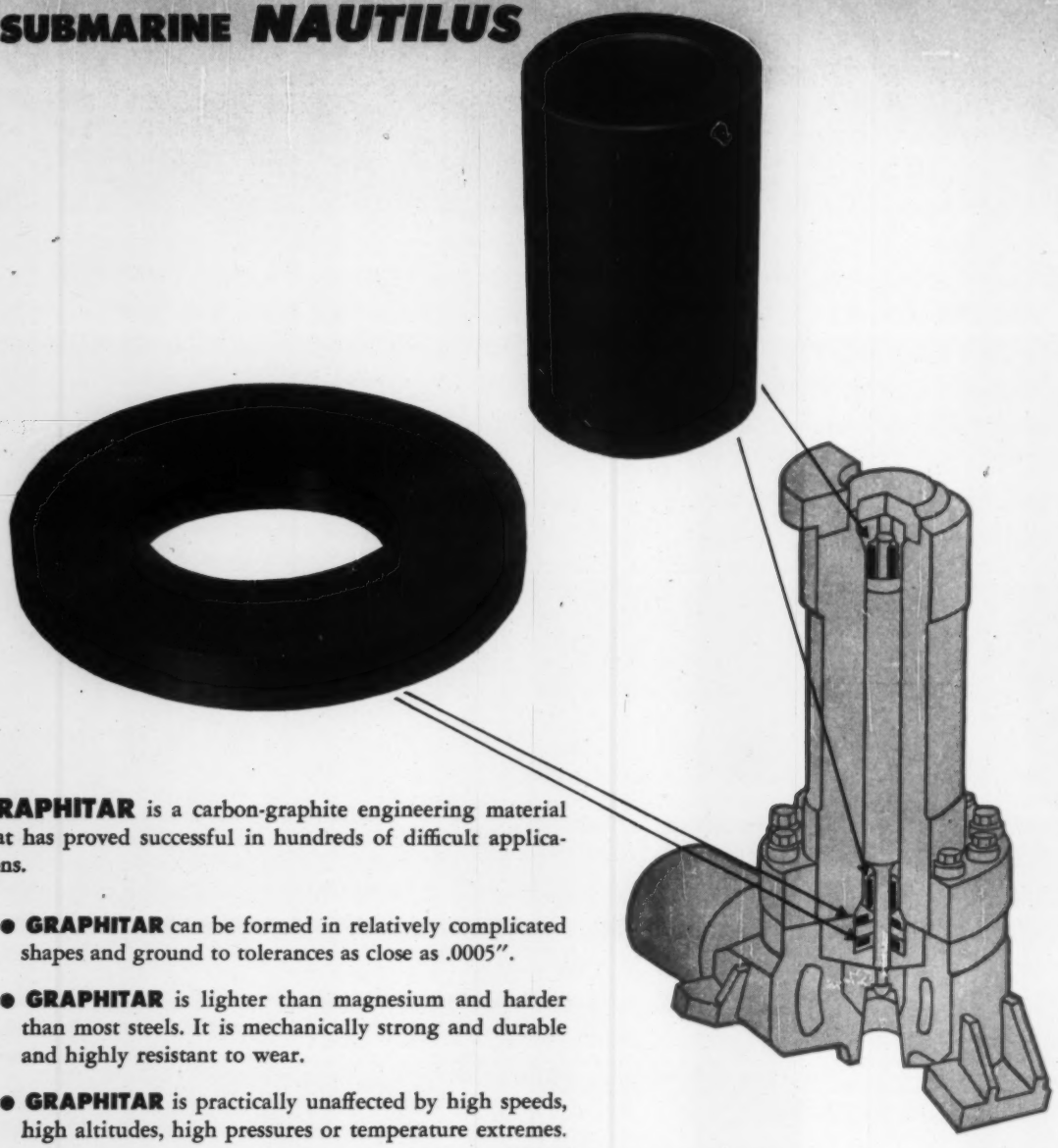
*Reg. U.S. Pat. Off.

DYNALOG

ELECTRONIC INSTRUMENTS

GRAPHITAR® HELPS HARNESS

THE POWER OF THE ATOM IN NEW ATOMIC SUBMARINE *NAUTILUS*



GRAPHITAR is a carbon-graphite engineering material that has proved successful in hundreds of difficult applications.

- **GRAPHITAR** can be formed in relatively complicated shapes and ground to tolerances as close as .0005″.
- **GRAPHITAR** is lighter than magnesium and harder than most steels. It is mechanically strong and durable and highly resistant to wear.
- **GRAPHITAR** is practically unaffected by high speeds, high altitudes, high pressures or temperature extremes.

THE UNITED STATES

The Westinghouse Electric Corporation, working closely with the Atomic Energy Commission, has designed and built the nuclear power plant for the first atomic-powered submarine, the Nautilus. In atomic power operations, where radioactivity is a difficult problem, fluid systems must usually be hermetically sealed because conventional pumps with external drive motors are not adaptable to this type of operation. For the submarine's power reactor, Westinghouse engineers developed special hermetically sealed pumps with integrated pump and drive motor. The bearings in these pumps, which are made of GRAPHITAR, must withstand high speeds, high temperatures, high pressures and must also operate for indefinite periods of time without maintenance with radioactive hot water as the only lubricant. All leakage past the pump seal is contained within the flooded motor while the purely electrical elements are contained in "cans" to exclude water.

When the Nautilus is put into service, the power to run its conventional steam turbine, which is the actual driving power for the submarine, will come from atomic fires in the reactor where controlled nuclear fission produces enormous amounts of heat. The heat is transferred to the boilers through a closed circuit where the boiler water is turned into steam which is used for driving the turbine. Continuous, trouble-free circulation is extremely vital in this system and it is here that GRAPHITAR is proving its ability to help harness the power of the atom for the future good of mankind.

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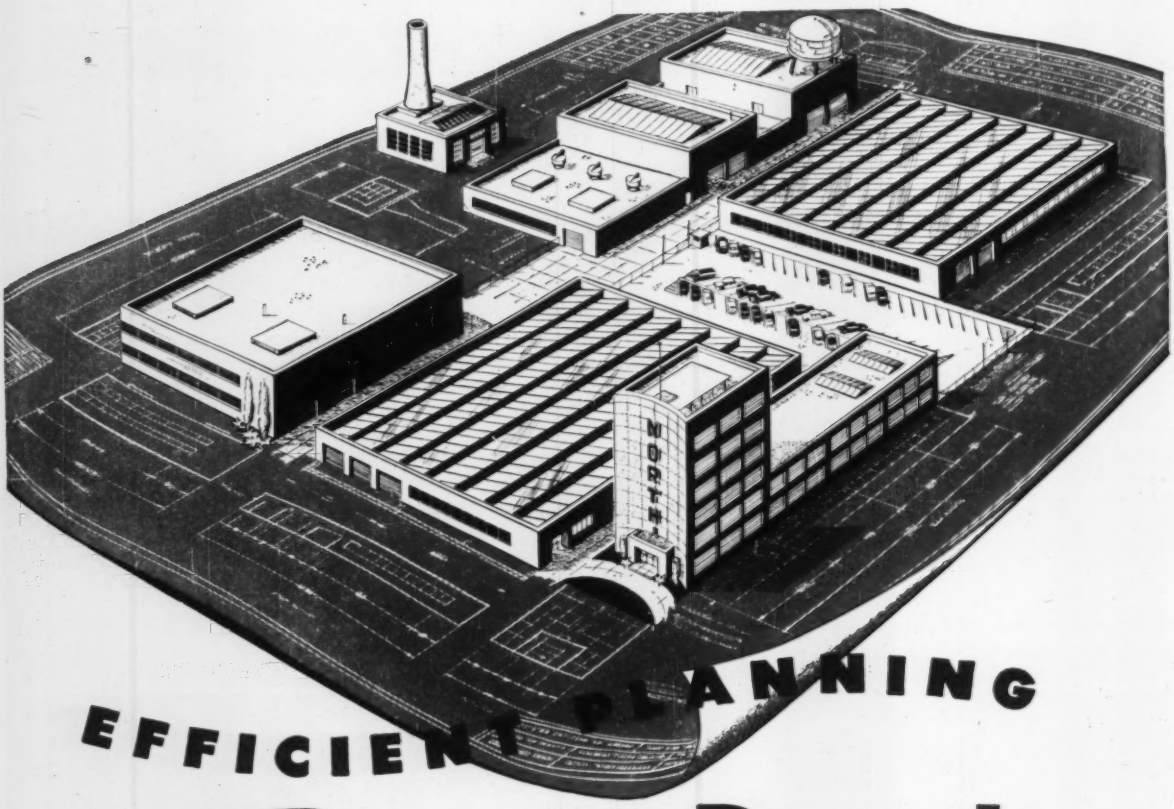
GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN



EFFICIENT PLANNING Starts with RIC·WIL

● Early planning with a RIC-WIL field representative on central heating or air conditioning systems will mean less work later on. Custom engineering and prefabrication of RIC-WIL units offer quick, efficient installation. RIC-WIL's engineering service with forty-five years experience in the Insulated Piping Field is available for *early* planning and consultation.

Write or phone your nearest representative or send for the illustrated RIC-WIL catalog.

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency

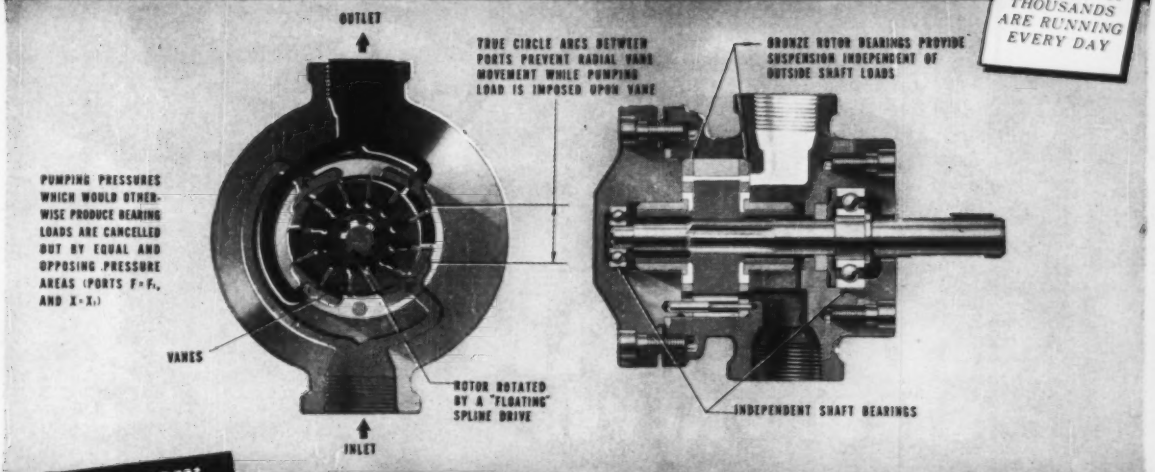
RIC·WIL INCORPORATED

PREFABRICATED **INSULATED PIPING SYSTEMS**

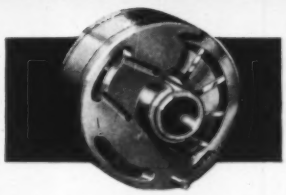
BARBERTON, OHIO

Question:
Why are VICKERS Balanced Vane Type Pumps the most widely used oil hydraulic power pumps?

HUNDREDS OF THOUSANDS ARE RUNNING EVERY DAY


OUTLET
TRUE CIRCLE ARCS BETWEEN PORTS PREVENT RADIAL VANE MOVEMENT WHILE PUMPING LOAD IS IMPOSED UPON VANE
BRONZE ROTOR BEARINGS PROVIDE SUSPENSION INDEPENDENT OF OUTSIDE SHAFT LOADS
PUMPING PRESSURES WHICH WOULD OTHERWISE PRODUCE BEARING LOADS ARE CANCELLED OUT BY EQUAL AND OPPOSING PRESSURE AREAS (PORTS F-F1, AND X-X1)
VANES
ROTOR ROTATED BY A "FLOATING" SPLINE DRIVE
INDEPENDENT SHAFT BEARINGS
INLET

Answer:
Because of their SUPERIOR PERFORMANCE and MANY OTHER BENEFITS for the user.



For more than two decades, the Vickers Balanced Vane Type has held the leading position among hydraulic power pumps . . . growing steadily in popularity. The various models (see below) are *the most widely used of all pumps in oil hydraulic service.*

Above is the pumping cartridge which is one of this pump's distinctive features. The many advantages listed at the right merit the thoughtful attention of anyone concerned with the selection and use of oil hydraulic pumps.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

1500 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices • ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N. J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA • WASHINGTON • WORCESTER

IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

COMPLETE HYDRAULIC BALANCE—Each inlet and outlet port is balanced by another equal in size and radially opposite . . . pressure-induced bearing loads are thus eliminated. Pressure-balanced porting plates maintain ideal running clearances.

FLOATING SPLINE DRIVE—Rotor is driven by a "floating" spline. Rotor and shaft have separate bearings . . . avoiding strain from drive misalignment.

TRUE-CIRCLE CAM ARCS between ports prevent radial vane movement while pumping load is imposed upon vanes. Wear between vanes and rotor is thus practically eliminated.

ABILITY TO TOLERATE DIRT—Clean oil is of great importance in a hydraulic circuit; but, in spite of care, dirt sometimes gets in. The Vickers Vane Type Pump will pass a reasonable amount of dirt without trouble and without grinding it up.

REPLACEABLE CARTRIDGE—Cartridge (illustrated above left) contains all pumping parts that move . . . none contact the housing. Working parts can be removed and inspected without disconnecting piping or drive coupling. Replacement cartridge kits are available and pumps need not be sent to the factory for repairs. Pump capacity can be changed by simply changing cartridge in the field.

HIGHER EFFICIENCY—Tests prove exceptionally high volumetric and overall efficiency . . . not only when pump is new but also after long service.

AUTOMATIC WEAR COMPENSATION—Vanes are held in contact with the cam ring by centrifugal force and hydraulic pressure. If wear occurs, vanes revolve in a slightly larger orbit without appreciable change in performance.

MINIMUM MAINTENANCE—Hydraulic balance . . . floating spline drive . . . independent bearings . . . automatic wear compensation eliminate the most important causes for maintenance and repair.

TEMPERATURE ADAPTABILITY—Correct running clearances are automatically maintained which compensate for wide variation in oil viscosity resulting from temperature variation.

LONGER LIFE—The numerous features mentioned above that keep down maintenance also contribute to longer life. Then, a new cartridge completely rejuvenates the pump.

CONSTRUCTION SIMPLICITY is evident from the illustrations above. This simplicity is another reason for the superiority of Vickers Vane Pumps. For further information, ask for Bulletin 5002A.

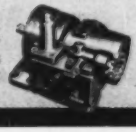
7182

ALL MODELS HAVE THE VICKERS ADVANTAGES MENTIONED ABOVE

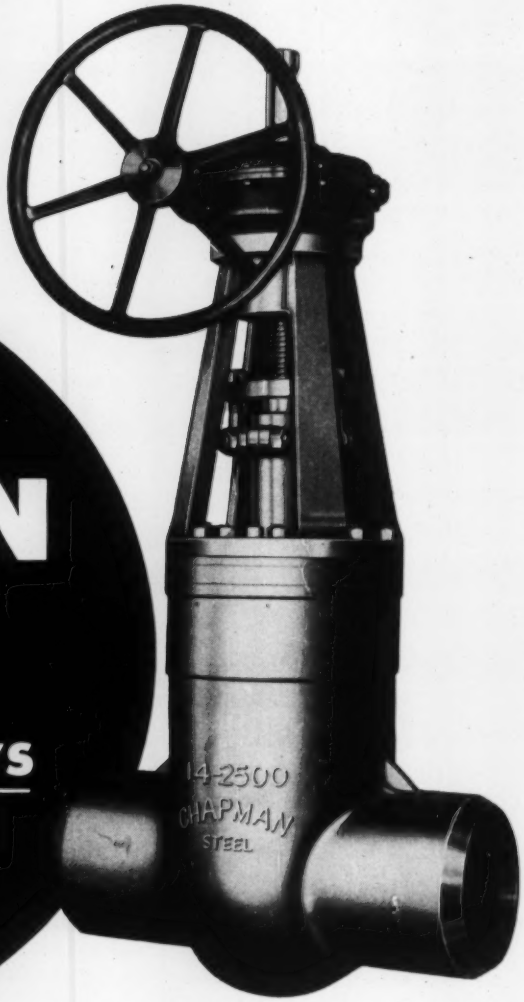
Single Stage. Pressures to 1,000 psi. Capacities to 55 gpm.

Two Stage. Pressures to 2,000 psi. Capacities to 55 gpm.

Double Pump—Two pumps for separate circuits driven by common shaft.



Two-Pressure Pump automatically delivers larger volume at low pressure and smaller volume at high pressure.



Specify CHAPMAN STEEL VALVES

in any of the Standard Alloys

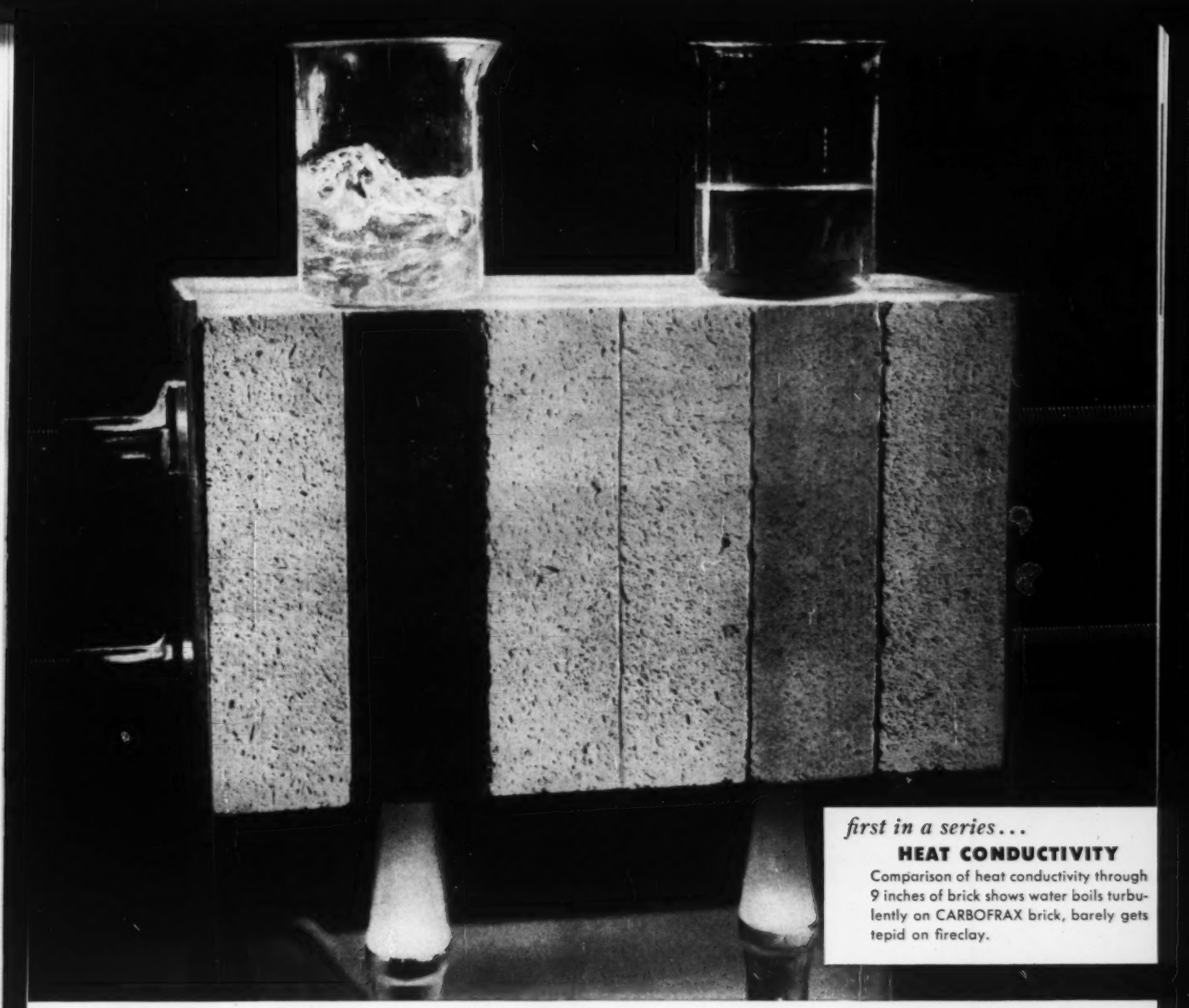
to meet your steel valve needs

When you specify Chapman Steel Valves you also specify steels designed for your specific services. Standard alloy steels match every normal industrial requirement. Special alloys can be furnished for extraordinary service conditions. All metals are poured in Chapman's own foundries under rigid laboratory supervision.

Exceptionally close machining tolerances are another standard feature of Chapman Steel Valves. Under the most severe conditions, Chapman Steel Valves seat tightly and positively, without jamming, chattering, or wearing excessively. Operation remains smooth and dependable; maintenance costs stay low.

See Chapman *first* for gates, globes and checks in all pressure classes — 150, 300, 400, 600, 900, 1500 and 2500 pounds — and for temperatures to 1150°F. Valves are available with welded, pressure seal, or bolted bonnet joints and with flanged or welding ends. ASA standards are equalled or exceeded in every range. Write for Catalog 20.

THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS



first in a series...

HEAT CONDUCTIVITY

Comparison of heat conductivity through 9 inches of brick shows water boils turbulently on CARBOFRAX brick, barely gets tepid on fireclay.

Unusual Properties of Refractory Materials

High heat conductivity — roughly 11 times that of fireclay and about 70% that of chrome-nickel steels — is one of the properties of CARBOFRAX® silicon carbide refractory brick. It is an ideal material for muffles, radiant tubes, retorts and similar structures where you need exceptional resistance to direct flame *plus* the ability to conduct heat efficiently. At 2200°F, thermal conductivity of CARBOFRAX brick is 109BTU/hr., sq. ft. and °F/in. of thickness.

CARBOFRAX refractories typify the many super refractories pioneered by Carborundum. Each has a wide range of properties. One, for example, is formed into precision parts that look like cast iron yet resist over 3000°F. Another, a new ceramic fiber, filters and insulates at temperatures no existing mineral or glass fiber can take.

Carborundum's new magazine "Refractories" pinpoints many practical applications for these unusual products. The forthcoming issue carries a feature article on "Heat Conductivity". Send for your copy today.

CARBORUNDUM

Registered Trade Mark

VALUABLE INFORMATION FOR USERS OF:

REFRACTORIES • CASTABLE CEMENTS • POROUS PLATES AND TUBES

CATALYST SUPPORTS • OXIDE, BORIDE, NITRIDE AND CARBIDE

HIGH-TEMPERATURE MATERIALS • CERAMIC FIBER

all in the new magazine "Refractories"

—MAIL THIS COUPON TODAY—

Dept. 116, Refractories Division
The Carborundum Co., Perth Amboy, N. J.

Please send me the forthcoming issue of "Refractories".

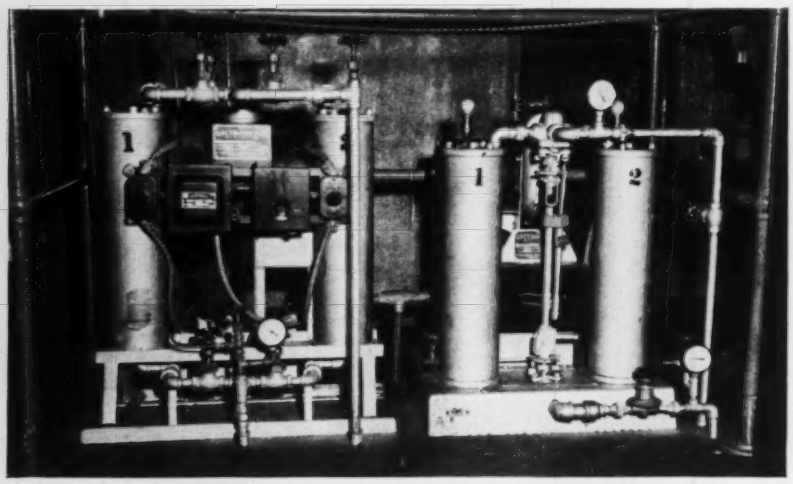
Name_____ Title_____

Company_____

Street_____

City_____ Zone_____ State_____

Flushed with DRY air, filled with DRY oxygen...



DRY air and DRY oxygen are supplied to Flashbulb filling machines at Sylvania Electric Products, Inc., Montoursville, Pa., by these two BAC-O Lectrodryers.

dried to -70° dewpoint

THE PROMINENT POSITION occupied by these two Lectrodryers* in the heart of this Sylvania plant is evidence of the importance of DRYing in this process. The air with which Flashbulbs are flushed, and the oxygen with which they are filled, are dried to –70°F. dewpoint. Thus Sylvania makes certain of the high quality demanded in these products.

DRYing, as here at Sylvania, is an ingredient in certain processes; air, gases and organic liquids are specified to be free of all entrained and vaporous moisture. DRYing is a production tool in many manufacturing operations. It speeds up the coating of television tubes, for example, and the curing of transformer insulation. Stockrooms, where finished products are stored, must be kept DRY to safeguard their quality.

Whatever your troubles with unwanted moisture, Lectrodryer engineers can help you solve them. The book, *Because Moisture Isn't Pink*, tells how they've helped others. For a free copy, write Pittsburgh Lectrodryer Corporation, 335 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

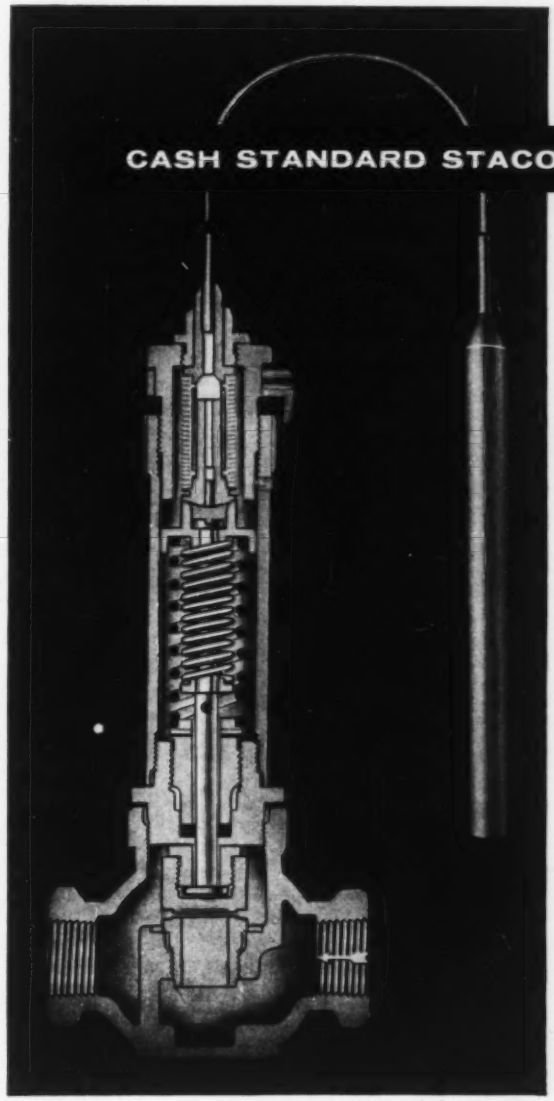
LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

Cash Standard Expands

by the addition of

Stacon Temperature Regulators

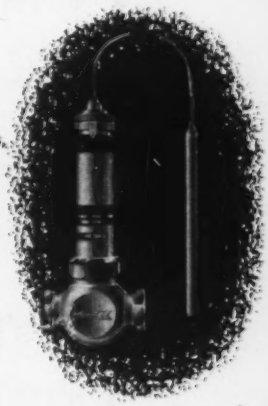


This line of temperature regulators (formerly manufactured by Farris Stacon Corp.) rounds out complete Cash Standard line of valves to solve any problem of temperature regulation or pressure control.

CASH STANDARD STACON TEMPERATURE REGULATORS

- Provide accurate temperature control for use with steam, liquids and gases.
- Self-operating and self-contained pilot-operating.
- Direct and reverse acting.
- Liquid filled thermal system for high operating power and uniform throttling action.
- Extremely compact construction with rugged field-replaceable thermostatic system.
- Overload protection to prevent overstressing of thermostatic system at over-range temperature.

Recommended for hot water heaters, tanks, kettles, plating tanks, bottle and can washers, degreasers, ovens, fuel oil heaters, brine circulating, process cooling, jacket cooling for compressors, diesel and gas engines, and many other uses.



What is *Your* Temperature Regulation Problem?

Cash Standard has the Answer!

Contact your Cash Standard control specialist or write Dept. C.

CASH STANDARD

A. W. CASH COMPANY, P. O. Box 551, Decatur, Illinois

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Twice the life of materials previously used is reported for this group of Ni-Vee bronze half bearing castings used in the first six or eight rolls each side of rollout table on large reversing mills. Ni-Vee type bronze castings are used for various heavy duty steel mill maintenance jobs. Castings shown on this page were produced by A. W. Cadman Manufacturing Company, Pittsburgh, Pa. under their trade name "NICUITE."

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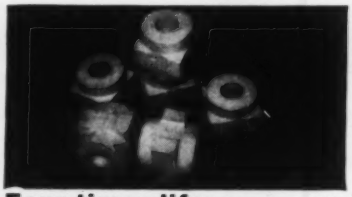

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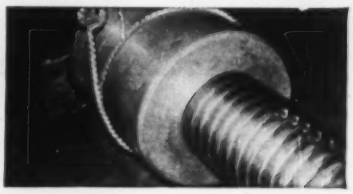

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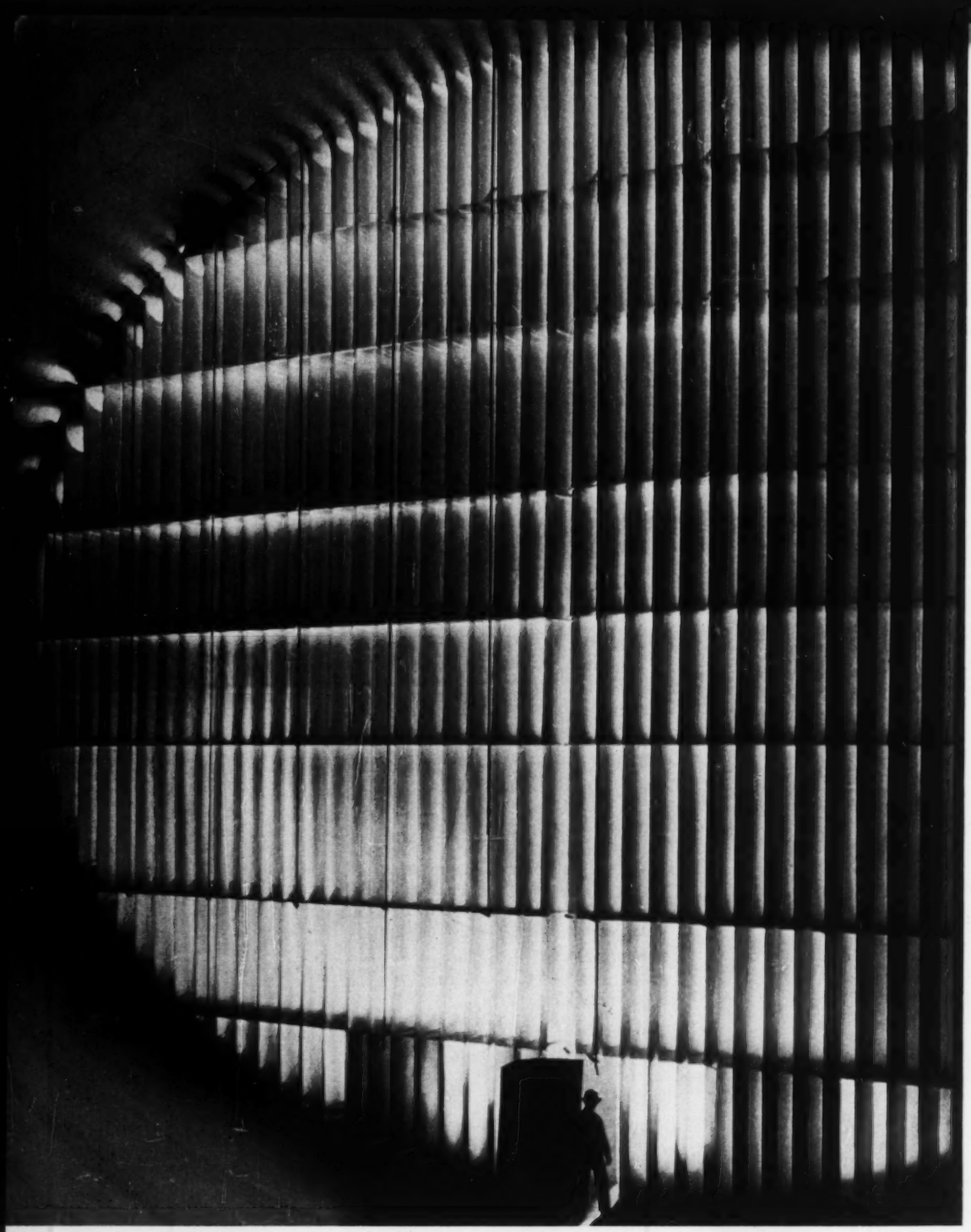

Air flow in new Propulsion Wind Tunnel . . .

. . . is controlled by these giant turning vanes at a corner of the Propulsion Wind Tunnel's transonic circuit at the U. S. Air Force's Arnold Engineering Development Center, Tullahoma, Tenn. The tunnel is 55 ft in diam at this point (the ducting varies from 35 to 55 ft, and a two-lane highway could be built through all of it). Air, rushing through the tunnel at speeds up to 1100 mph, is directed by the turning vanes into the huge test section (16-ft sq, 40-ft long) where full-size operating ramjet and turbojet engines, mounted as they will be in actual flight, are subjected to test conditions. The Propulsion Wind Tunnel is the largest of the major laboratories at this Air Research and Development Command installation. It is part of the nation's Unitary Wind Tunnel Plan.

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JANUARY 1956
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George A. Stetson, *Editor*

MECHANICAL ENGINEERING

Perception and Perspective Needed

In his report to the members presented at the 1955 ASME Annual Meeting (see pages 4-6 of this issue) President Morgan included in a five-point program establishment of a board or committee whose sole function will be to contemplate and anticipate changes in technology to the end that the Society may have a forward-looking plan in creating new Sections or Divisions to fit the needs of the mechanical-engineering profession.

As a stimulus to the advancement of the Society and its usefulness not only to members but to the nation, such a group could have a profound effect. The field of mechanical engineering is growing rapidly and is extending its borders to include application of an increasing number of scientific discoveries and contacts with ever-changing social and economic conditions. Although the bulk of traditional areas of technology will continue to demand and deserve all of the refinements of extension and development able specialists can bring to bear upon them, new ones will appear upon the scene and new groups of specialists will arise to serve them. These specialists need a "home" within the framework of an existing organization such as ASME; and unless the Society is prepared and willing to welcome them, the alternative course will be the formation of new splinter groups.

The qualifications for membership in the group which Dr. Morgan suggests will include, along with broad interests and some considerable acquaintance with advances in the physical and social sciences, those of perception and perspective. What is needed is men with bold imagination and a quality of mind which seeks always to bring together the stray bits of knowledge discovered by specialists in hundreds of fields into an orderly and integrated body of human knowledge for the benefit of mankind, for that, after all, is the time-honored function of the engineer.

One scarcely expects the engineer himself to uncover the secrets of nature and the essential relationships of men as social beings which are so important in the progress of civilization. One expects the engineer to apply the discoveries of scientific specialists whose task it is to further these ends. One also hopes that in applying these discoveries, the engineer will exercise intelligence, perception of the good, and possibly evil, effects that may develop therefrom, and vision to see in perspective the major consequences of applying additions to human knowledge in his work. Engineering cultivates specialists of its own whose knowledge and talents must be given purpose and direction if beneficient results are to dominate their activities. Because of his position in modern society as one of the group which applies human knowledge and thereby affects the lives of others, each engineer assumes an obligation to mankind which engineering shares with other professions and the universities. Hence, in addition to considering the future welfare of ASME, such a board or committee as Dr. Morgan suggests should also concern itself with the very broadest and sometimes obscure aspects of the work of mechanical engineers.

Perhaps this task is too general and too important to be added to that already laid down by Dr. Morgan. To attain its objective in respect to society as a whole as contrasted with ASME in particular, the board or committee will need to include, in addition to engineers, men of perception and perspective drawn from the natural and social sciences whose discoveries may have significance and importance in mechanical engineering. One thinks of the biological sciences, for example, already integrated with engineering in certain areas such as industrial hygiene, sanitation, air pollution, and the like, which are of extreme importance in an age which is beginning to let loose in much larger quantities than man has been subjected to in the past, radiation from atomic power plants, wastes, and isotopes which may have serious genetic effects on future generations. The fields of geriatrics, cybernetics, psychology, food supply, new energy sources, and others, should be studied by men who, as engineer managers, will assume a greater influence in future than in the past over those who find employment in an industrial economy.

The task which needs to be done will require more effort than a single board or committee can put forth. What is needed is leaders in every Section and Student Branch who will surround themselves with men having broad and varied interests and a desire to cross-fertilize the knowledge they possess as specialists. Such groups should discuss important questions not normally considered at technical sessions and provide speakers who can carry the results of the group's thinking into the meetings and publications of the Society. The result should be an intelligent development of engineering in which members, the other professions, and the public will benefit through the powers of perception and perspective exercised by groups representative of all significant aspects of human knowledge.

The Future of ASME

In his report to the Society the President discusses Administration, the Technical Life of the Society, Aims and Objectives, Student Branches, New Awards and Honors, Professional Unity, the New Engineering Center, Woman's Auxiliary, and International Field

By David W. R. Morgan

President, The American Society of Mechanical Engineers

I WELCOME this opportunity to report to you on the accomplishments of this Society. With your permission, I will venture a look into the immediate future of this organization.

Administration

The new assignments of staff duties initiated by the Secretary are to become effective Jan. 31, 1956. The various Boards and Committees will be given the details within the next few weeks. Essentially, there will be these divisions or services:

The Technological Service, with Assistant Secretary T. A. Marshall, Jr., as head, and George A. Stetson, Editor, as the associate head, which will be responsible for the text publications and the activities of Professional Divisions, Meetings, and Research.

The Field Service, headed by Assistant Secretary O. B. Schier, II, will be responsible for serving the Vice-Presidents, the Admissions Committee, and the activities of the Sections, Student Branches, and Membership Development.

The Office Service, headed by Assistant Secretary and Controller D. C. Bosworth, will serve the Finance Committee and be responsible for accounting, mailing, stores, shipping, filing, central typing, and related services.

The Publications Service, headed by Stanley A. Tucker, Assistant Secretary and Publications Business Manager, will be responsible for the sale of publications and advertising.

The Codes and Standard Service, for which the Secretary will act as temporary head, will serve the Boiler and Pressure Vessel, Power Test, Standardization, and Safety Code activities.

The heads of the respective services will be given very definite authority and responsibility, so that they may administer and operate these services in the most efficient manner.

Technical Life of the Society

We have had a very successful year in the field of technical activity thanks to the Board of Technology, chaired by Ronald B. Smith, which has accomplished a great deal in stimulating and co-ordinating these activities of the Society.

I can assure you the Board is mindful of your needs with respect to the literature, publication space, and allocation of meeting time. Though faced with a tremendous problem, they are making real progress.

A summation of the 18 National Meetings and Professional Division Conferences may be of interest to you: Time consumed, 50 days; sessions, 256; papers, 682; preprints 530; and total attendance, 14,375.

Professional Divisions. Two new Professional Divisions were established, Nuclear Engineering and Lubrication.

Progress is being made in promoting better Section cooperation and clarifying the structure and relationship of the Professional Divisions.

Aims and Objectives of the Society

It was gratifying to note the interest manifested by the membership in response to the questionnaire sent to the members in July, 1954; 36,741 questionnaires were mailed and replies received from 20,575, or 56 per cent.

The purpose of the questionnaire was to obtain facts about the members' specialized interests and activities, which should improve our operations in Professional Division organization, publication policy, and planning programs for National, Regional, and Sectional meetings and conferences.

This information has been distributed to members of the Council, Organization, Publication, Meetings, Membership Development, and Regional Committees, also to the Professional Divisions and delegates to the RAC meetings.

A summary of the data appeared in the March and the April, 1955, issues of MECHANICAL ENGINEERING.

The group, who worked so hard to tabulate, compile, and put this information into workable form, deserves a hearty "thank you."

The Society can be proud of its accomplishments during its 75 years of existence. We have adhered to the basic objectives of the Society, namely:

A Advancing the theory and practice of engineering and the allied arts and sciences by:

1 Encouraging engineering research, tests, and other original work.

2 Encouraging the preparation of original papers on engineering topics.

3 Holding meetings for the presentation and discussion of original papers and participating in international engineering congresses.

4 Publishing papers and reports and disseminating knowledge and experience of value to engineers.

Delivered at the President's Luncheon, Diamond Jubilee Annual Meeting, Chicago, Ill., Nov. 13–18, 1955, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERING.

5 Encouraging intercourse among engineers for mutual exchange of knowledge and experience.

6 Developing and promulgating standards, codes, formulas, and recommended practices.

We can look back on an illustrious past. What of the future which holds so much promise for the professional engineer and The American Society of Mechanical Engineers?

Your Council, feeling the need of guidance in planning the future, has asked the Regional and the Administrative Committees, the Professional Divisions, and the Headquarters staff to present their views. These returns are being analyzed with considerable profit by the Organization Committee, and a preliminary progress report will be presented for informal discussion at this Annual Meeting.

Our objectives for the next 25 years should embrace these aims:

1 Qualified membership of at least 80,000 by 1980, with a time schedule for accomplishment.

2 Intensified efforts to occupy and retain a position of leadership in an era of technological complexity, advancement, and radical changes.

3 Acceptance in the public mind as representatives of the best in professional engineering and moral standing.

4 Continuation of a policy in Society matters that will demand the respect of engineers and scientists throughout the world.

5 The establishment of a board or committee whose sole function will be to contemplate and anticipate changes in technology to the end that the Society may have a forward-looking plan in creating new sections or divisions to fit the needs of the mechanical-engineering profession.

Student Branches

The future growth and prosperity of the Society depends to a large degree on the growth and expansion of an important segment of the Society—the Student Branches.

Here is a field where the Headquarters, Regional Vice-Presidents, and Sections can greatly aid the faculty advisers and officers of the Student Branches. In most instances, the faculties are doing a conscientious job, but they need and would welcome the assistance of active practicing engineers. We can help the Student Branches by improving our lines of communication.

I recommend that:

1 Headquarters develop a plan of direct communication with the student officers, or through the faculty adviser.

2 The Sections charged with the responsibility of a Student Branch, through its secretary, keep the Branch informed of its activities, particularly the meetings of special significance to the student engineer.

Newly Established Society Awards and Honors

This year, three new awards were established, to be administered by the Society.

In October, 1954, the Society received a grant of $7000 from the Blackall Foundation and the Taft-Peirce Foundation to administer the Blackall Machine Tool and Gage Award.

The Blackall award was established to stimulate a continuing interest in the Society concerning the problems of machine tool, gage, and dimensional measuring instrument design and application.

Second was the Arthur L. Williston Medal and Award. Mr. Williston presented the Society with securities valued at $17,000 to support this award. It is to be presented to the student or junior engineer who may submit the most effective written proposal for changes in the undergraduate engineering curricula or environment that will emphasize to the mechanical-engineering student the importance of participation in civic affairs.

Another grant is the Elmer A. Sperry Award, in honor of Elmer A. Sperry, the 48th President of the Society. Mr. Sperry's daughter, Mrs. Robert Brooke Lea, and his son, Elmer A. Sperry, Jr., have given the Society the responsibility of administering this award. It is to be bestowed for the engineering contribution which best serves to advance the art of transportation by land, sea, or air.

The Selection Board represents four Engineers' Societies: The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, Society of Automotive Engineers, and the Society of Naval Architects and Marine Engineers.

The Society is custodian of $16,000 to support this Award.

The Blackall and the Sperry Awards will be presented at this Annual Meeting. The Williston Award, now being publicized, should see its initial recipient by the fall of 1956.

At this time, may I suggest that Society members familiarize themselves with the attractive list of honors and awards that are available and thus prepare themselves to take a personal interest in nominating candidates who meet their requirements.

On behalf of the Council, I take this opportunity to recognize publicly the generosity of these donors. Their grants should serve to stimulate the imagination and curiosity of inquiring minds in technical and other professional fields, with real benefits to our profession and the everyday world.

Professional Unity

One of the problems, common also to our sister societies, with which the Society must deal is designated as "the Unity of the Profession." This embodies a possible change in the alignment of existing Society organizations or the creation of some new ones that will be able to "speak" for the profession on matters of public concern and broad policies of the engineering profession. The discussion of this problem centers largely on the relative merits of a federation of existing bodies, or a society of individual members, or a combination of the two ideas.

We must be mindful of the fact that the engineering profession has grown rapidly in the past 25 years, and the practice of engineering has become more complicated. Each society has its own ideas as to how the goal of professional unity should be achieved.

We had expected to obtain professional unity through the creation of the American Engineering Council; however, this was unsuccessful.

It takes time to consider and reconcile many different points of view. I want to assure you that your Council is giving the matter of "professional unity" very thoughtful consideration. Sincere people in our sister

societies are discussing the differing points of view in good faith. We have every reason to feel that professional unity will be realized through the combined efforts of the societies and the Engineers Joint Council. We must have patience and faith in the governing bodies of our societies to find a solution acceptable to all.

The New Engineering Center

For the benefit of our newer members, funds for the Engineering Societies Building in New York which we occupy today were provided by Andrew Carnegie a half century ago. When the societies outgrew this facility several years ago, a study was initiated for acquiring a new headquarters building.

The preliminary work on the project was done by United Engineering Trustees, Inc. This group consists of three representatives of each of the Founder Societies and it acts as the holding company for the societies.

A little over a year ago, a committee of presidents representing ASCE, ASME, AIEE, AIME, and AIChE was formed to assist in reaching a decision. On Feb. 2, 1955, a majority of the five presidents reported to our Council that "based on the lowest capital cost and lowest annual expenditure, we recommend that the headquarters of the engineering societies be located on one of the sites in the City of Pittsburgh."

Later, the committee of five presidents was asked to submit a more definite report, which would include all the factors it considered in making its recommendations. The five presidents reported on April 13, 1955. The majority report was signed by four members. It included an analysis of the available data and recommended the Schenley site in Pittsburgh. A minority report signed by one member of the committee was also considered.

The report of the five presidents was discussed at the Boston meeting, and alternative suggestions presented. Agreement was reached between the five societies to set up a task committee of fifteen, three from each society.

At its meeting on Sept. 22, 1955, the Executive Committee of the ASME Council appointed a committee of three past presidents—E. G. Bailey, New York; James W. Parker, Detroit; and James M. Todd, New Orleans—to serve as ASME representatives on the Task Committee which is charged with "the duty of recommending a specific site for the Engineering Societies Center, based upon a review and comprehensive additional study of feasible locations."

The Task Committee of 15—three from each Society—held its first meeting on Oct. 10, 1955, and elected B. F. Dodge, president of the American Institute of Chemical Engineers, as chairman, and H. DeWitt Smith, president of the American Institute of Mining and Metallurgical Engineers, temporary secretary. This sums up the report to date.

Woman's Auxiliary

We are honored to have with us today at the head table Mrs. Hilda Karg, president of the Woman's Auxiliary to The American Society of Mechanical Engineers.

I can vouch for the effective and efficient work done by the Auxiliary while acting as hosts to the ladies at the last Annual Meeting in New York, the Spring Meeting in Baltimore, the Oil and Gas Power Conference in Washington, and the Semi-Annual Meeting in Boston.

The Auxiliary reports a membership of 1,371, operating through 18 sections, with an additional section now being organized in Honolulu. Ladies and gentlemen, this may be the entering wedge for a meeting of the Society in Honolulu!

The Woman's Auxiliary maintains three educational funds. The Calvin W. Rice Scholarship of $1500 was awarded to Vaskin Najarian of Lebanon for 1955–1956, who will study modern hydraulic machinery at the University of California. This I consider a fine gesture of international good will.

The Sylvia W. Farny Scholarship granted two scholarships of $500 each. One recipient was Roger S. Berkbigler, Missouri School of Mines and Metallurgy, University of Missouri. A veteran, he is married and has one child. Mr. Berkbigler is a member of the ASME Student Branch and Pi Tau Sigma.

The second recipient was Earl G. Johnson, Northeastern University of Boston. He also is a member of the Student Branch of the ASME and Pi Tau Sigma. Mr. Johnson was selected to represent Northeastern University in the Annual Rhodes Scholarship competition for graduate study at Oxford.

The Auxiliary has a very active student loan fund with 32 outstanding loans, amounting to $11,905, to students in 17 colleges.

International Field

Though I have gained many personal friends in Europe as a result of my company affiliation, I must admit my knowledge of international affairs in the profession is quite limited.

Thus I considered it my good fortune to be able to represent this Society, along with Secretary Davies, at the Fifth Conference of Engineering Societies of Western Europe and the United States (EUSEC). The American Society of Civil Engineers was represented by President W. R. Glidden and Executive Secretary W. H. Wisely.

Twenty-six representatives of fifteen engineering societies and twelve nations attended the meeting in Copenhagen, Denmark. The Danish Institution of Civil Engineers acted as host. The meetings were held in the attractive new building of the Institution.

I appreciated the opportunity of presenting honorary membership in our Society to the President of the Danish Institution of Civil Engineers, Georg Frederik Charles Dithmer, who well deserved the honor conferred upon him.

I was deeply impressed with the sincerity and seriousness of purpose manifested throughout the sessions and came away from them with the conviction that the meetings were worth the effort expended by all the participants.

Secretary Davies is to be complimented for the arrangements made with United States Ambassador Robert Coe and the Embassy staff to have the honors conferred at the American Embassy. It was a high light of the conference, and I am sure greatly enhanced the prestige of the engineering profession.

May I add that it became evident to me that our genial Secretary, Col. Davies, holds a high place in the minds and hearts of the engineering profession in Europe.

EUSEC has accepted an invitation to hold the next conference in the United States in 1958. I sincerely hope the engineering societies of the United States and Canada

(Continued on page 41)

"TASLAN"

. . . . *Textured Yarn*

By J. T. Rivers, Jr.

Industrial Products Research[1]

E. I. du Pont de Nemours & Company, Wilmington, Del.

The textile industry, as we have known it in the past, has been based primarily on either spun-staple yarns or on continuous-filament yarns. Today, there is a promising new middle ground in the form of Taslan textured yarns. It is the objective of this paper to describe these yarns in terms which will demonstrate that they constitute a third major system of textile materials, morphologically different from both staple and continuous-filament systems.

A TASLAN textured yarn normally consists of a continuous multifilament yarn in which every filament is formed into small randomly spaced loops several times per inch of length. Thus a 34-filament yarn might have as many as 70 to 80 loops per inch. The straight sections of fiber between the loops are locked together by twist to form a stress-bearing core which is responsible for tensile strength of the yarn, as is the case with spun, staple yarns. Both ends of each loop are mechanically locked into this stress-bearing core by friction so that as the yarn is stretched, the loops maintain their form up to, and past, the break elongation of the yarn. The loops survive all textile-processing steps and appear essentially unchanged both on the surface and in the interior of finished fabrics. The distribution of loops along the length of a section of Taslan yarn is clearly shown in Fig. 1(*b*) which is a photomicrograph comparing a Taslan textured nylon with a nylon continuous-filament yarn, a nylon staple yarn, and two cotton yarns. In fabric, the loops are most apparent on the surface, Fig. 2, where they contribute a dry staplelike hand; however, many of the loops are buried inside the fabrics where their prime function is to contribute bulk and openness.

[1] Textile Fibers Department, Textile and Industrial Products Research Division.

Contributed by the Textile Division and presented at the Diamond Jubilee Semi-Annual Meeting, Boston, Mass., June 19-23, 1955, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

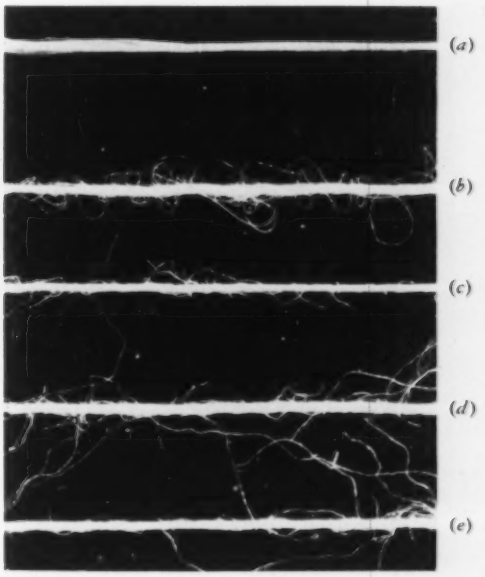

Fig. 1 (*a*) 80-68-13Z-200 nylon continuous-filament yarn; (*b*) 96T/80-68-13Z-200 Taslan textured yarn; (*c*) 50/1 spun nylon; (*d*) 50/1 cc cotton; (*e*) 100/1 cc cotton comparison of various yarns

Functional Characteristics

Although the texturing process can be applied successfully to practically any kind of yarn and the specific functional results in fabric will vary with fiber type, a number of effects are qualitatively similar regardless of fiber type. When compared with fabrics made from the parent continuous-filament yarn, the fabrics of Taslan have greater bulk, drier hand, higher covering power, and a more subdued luster. When compared with spun staple fabrics made from equivalent denier fibers, fabrics made from Taslan textured yarns have equal or lower bulk density, a drier crisper hand, significantly improved freedom from pilling and fuzzing, and much greater uniformity.

This uniformity is an outstanding characteristic of Taslan textured yarn. It is actually quite comparable with that of the parent continuous-filament yarn from which it is made.

A visual demonstration of the uniformity of Taslan textured yarn is furnished by Figs. 3, 4, and 5. In each case the same spun-dyed, black, cellulose-acetate warp was used. The fillings employed were a continuous-filament nylon, the same yarn converted to Taslan textured nylon, and a 50/1 cc cotton yarn. It is at once evident that the Taslan yarn, Fig. 3, is considerably more uniform than the spun-cotton control, Fig. 5, and has a uniformity equivalent to that of the continuous-filament control, Fig. 4.

Versatility

Denier and Product Range. The full potential of Taslan yarn has not yet been completely demonstrated, but it can be reported that yarns ranging from as low as 24 denier/20 filament to as high as 930 denier/140 filament have been prepared. These have been processed

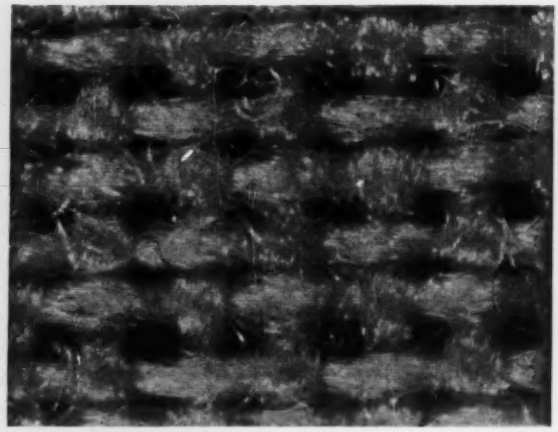

Fig. 2 Fabric of Taslan textured nylon yarn showing distribution of loops on the surface

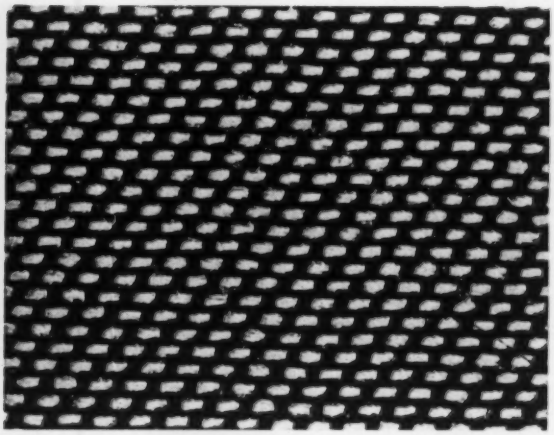

Fig. 3 Taslan textured nylon filling in black-acetate warp. Compare with Figs. 4 and 5

experimentally into a wide range of successful end-use articles, which include:

Lightweight woven fabrics such as shirtings, blouse fabrics, dress goods, woven lingerie, sheets and pillow cases, and neckwear fabrics.

Heavier-weight woven fabrics such as men's tropical suitings, women's suitings, men's year-round suitings, work-clothing fabrics, upholstery fabrics, polishing fabrics, and filter fabrics.

Knitted fabrics such as full-fashioned hosiery, half-hose, see Fig. 6, circular-knit jersey, tricot fabrics, men's knit athletic shirts, men's knit underwear shorts, and knit neckwear.

Blends. Whereas ordinary continuous-filament yarns can only be blended (1) by plying whole filament bundles and twisting, or (2) by weaving pick-and-pick or end-and-end, the texturing process permits intimate blending of the filaments of two originally distinct yarn bundles. When properly done, the limits of the two original fiber bundles are practically indistinguishable and they can be separated only with great difficulty. This freedom to blend also permits such accomplishments as the intimate blending of continuous-filament "Dacron" polyester fiber with continuous-filament rayon to produce Taslan yarns for fabrics having reduced static propensity.

Controlling Aesthetic Properties of Fabrics

Apart from changing the chemical type of the fiber, the factors which can be manipulated to vary the aesthetic properties of fabrics from Taslan in any given construction are filament denier, fiber cross section, twist, loop size, and loop frequency.

Filament Denier. Filament denier must be chosen correctly, for a given end-use, since the permanently stressed nature of the loops apparently magnifies the tactile effect of filament size. For example, whereas a 2.5-denier "Orlon" continuous-filament acrylic yarn made a satisfactorily soft shirting, the same 2.5-dpf yarn, when textured, produced a fabric which was noticeably harsher in contact with the skin.

In shirtings of Taslan textured nylon, most wear testers preferred fabrics made from 1.2-dpf yarn to those made from 2.1. However, a few wearers preferred the greater crispness of the 2.1-dpf Taslan yarn.

To summarize the effect of filament denier on products from Taslan yarn: For greater softness, lower filament denier; conversely, for greater crispness, increase filament denier, but with caution, since the loops magnify the effect of the increase. In addition, at equivalent filament denier, fabrics from Taslan are slightly harsher and crisper than staple fabrics of corresponding construction

Cross Section. In continuous-filament fabrics and in staple fabrics, changing from a round to a "dogbone" or a flat "ribbon" cross section usually produces a softer fabric, owing to decreased stiffness of the fiber in one direction. In the case of Taslan, however, changing from round to ribbon produces a harsher fabric with a drier hand and more surface "tooth." This effect is attributed to the ability of the loops to keep fibers protruding from the plane of the fabric against pressure, which would flatten the same fiber were it merely the outboard end of a single piece of staple. In short, the looped ribbon or dogbones cross sections stand under conditions where a cantilever ribbon or dogbone would fall.

Twist. Twist performs an important function in anchoring the loops in the textured-yarn bundle. Proper choice of turns per inch contributes largely in attaining desired yarn characteristics such as bulk, fullness, and producing added character in the resultant fabric. In general, higher twist gives crisper handle to the textured-yarn fabrics. As shown in Table 1, the total twist normally required for textured yarn is less than for corresponding warp or knitted-jersey spun yarns. The

Table 1 Twist Required for Various Yarns

Total yarn denier	Textured-yarn twist	Equiv. cotton count	Spun-yarn warp twist	Spun-yarn knitting twist
50.....	21	106/1	44–50	32
100.....	13–15	53/1	25–29	18
200.....	10	21/1	16–18	11
500.....	7	11/1	12–13	8
750.....	6	7/1	9–10	7
1000.....	5	5/1	8–9	6

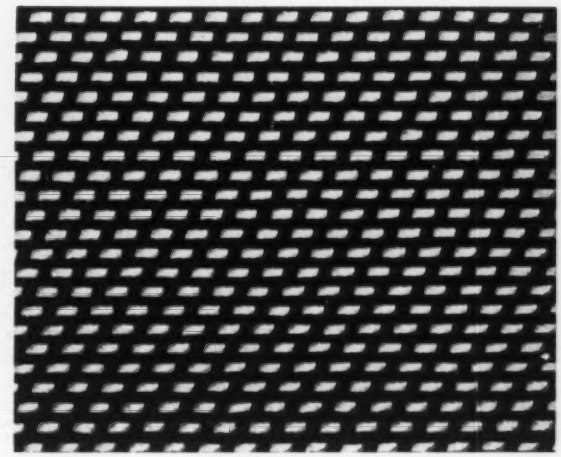

Fig. 4 Continuous-filament nylon filling in black acetate warp —Taslan of Fig. 3 shows some uniformity

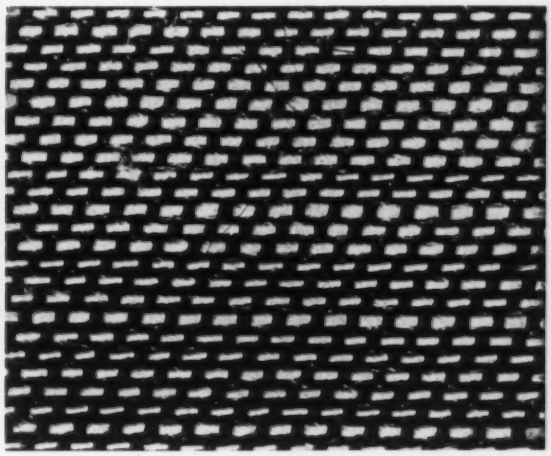

Fig. 5 50/1 cc cotton filling in black acetate warp lacks uniformity of Taslan textured nylon

spread in twist difference is more apparent in finer-size yarns.

The twists listed in Table 1 are adequate to produce sufficient yarn stability for weaving or knitting without loss of loops. They hold for filament deniers ranging from 1 to 6.

Loop Size and Frequency. Loop size and frequency can be controlled within limits. The effect of varying these has not been studied exhaustively, but it can be said qualitatively that:

(*a*) As loop size increases, Taslan yarn and fabric lose bulk, lose dryness of hand, and become softer.

(*b*) As loop frequency increases at constant loop size, fabrics become more bulky and drier in hand. At the same time, they gain in covering power and their surface luster is reduced.

Physical Properties

The tensile properties of Taslan yarns lie between those of continuous-filament yarn and staple yarn of equivalent chemical type and intrinsic fiber properties. This is illustrated by the typical stress-strain curves in Fig. 7. In general, yarn tenacity and modulus are lower than continuous-filament yarn, and higher than spun yarn. Elongation is higher than continuous-filament and lower than spun yarn.

The stress-strain curves in Fig. 7 represent a general statement of the yarn physical-property data obtained on sets of Taslan yarns, continuous-filament yarns, and spun staple yarns in five fiber-type categories; i.e., nylon, Dacron polyester fiber, Orlon acrylic fiber, acetate, and rayon. The test yarns were all made into fabrics. Although fabric weights and constructions were not completely equivalent, it was generally observed that:

1 In tenacity, elongation, and modulus, the Taslan yarns more closely resembled spun yarn than continuous-filament yarn.

2 The fabrics from Taslan had equal, or lower, bulk densities than spun-yarn fabrics and had substantially lower bulk densities than continuous-filament fabrics.

3 In crease recovery, and liveliness, the fabrics from Taslan were not substantially different from continuous-filament and spun-yarn fabrics.

4 Where pilling was a problem, the fabrics of Taslan were superior to those from spun yarn, and performed more like those from continuous filament.

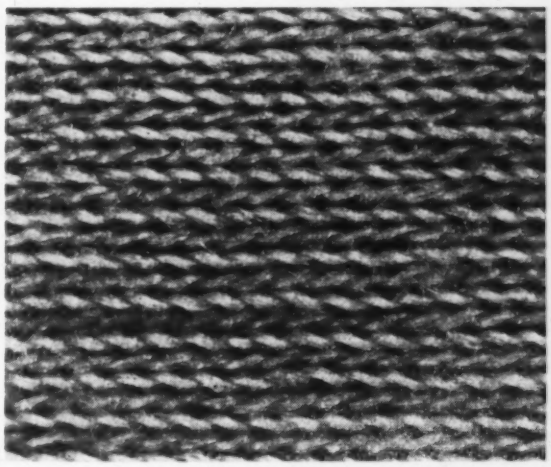

Fig. 6 Knitted fabrics—half hose of Taslan textured yarn

Difference From Stretch Yarn

In view of wide interest in certain modified continuous-filament yarns, having unusual elastic and bulk characteristics based on a highly randomized crimp such as "Helanca" or "Banlon," it is important to define how these products differ structurally and mechanically from Taslan. Neither Helanca nor Banlon possesses a stress-bearing core. Their ability to produce bulk and cover in fabric is associated with their high degree of crimp in the relaxed state. This results in their being used principally in knit goods or open-weave woven goods where shrinkage of the fabric structure permits the crimp to

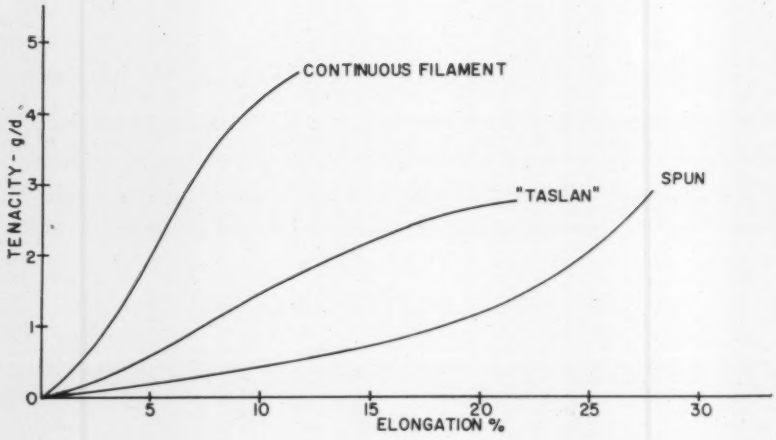

Fig. 7 Typical stress-strain curves of representative yarns

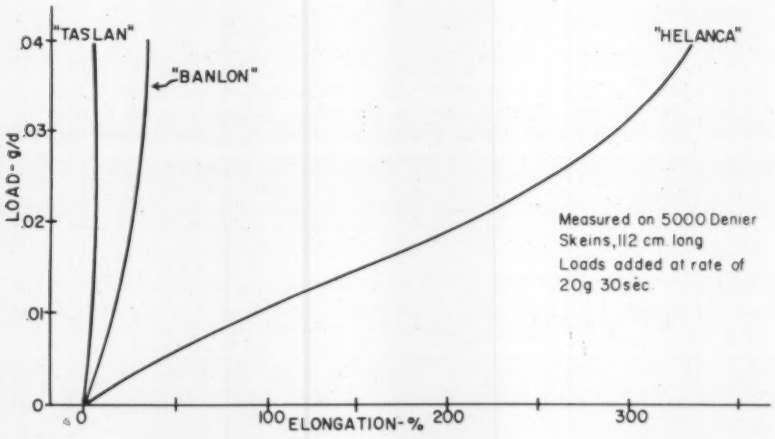

Fig. 8 Comparison of stress-strain properties of bulked yarns prepared from 70-denier/34-filament nylon

develop, resulting in useful elasticity in one or more directions.

By contrast, Taslan yarns can be used in the tighter fabric constructions generally employed for conventional spun-staple or continuous-filament yarns.

A quantitative demonstration of the difference between the tensile characteristics of relaxed samples of Taslan yarn, Helanca yarn, and Banlon yarn is given by the stress-strain curves in Fig. 8. These curves show the elongations produced by the very low tensile loads necessary to straighten the crimp of Helanca and Banlon yarns. Whereas such low loads produce a considerable elongation in yarns which depend upon crimp for cover and elasticity, they produce quite minor elongation in Taslan yarn owing to the high modulus of its stress-bearing core.

Textile Processing of Taslan

The bulk, surface characteristics, and tensile properties, of Taslan textured yarn make it desirable to treat it as a spun staple yarn in throwing, warping, sizing, and weaving. In dyeing and finishing the resulting fabrics, experience with continuous filament will apply, since the fiber is intrinsically continuous filament.

During at least the early stages of development work with Taslan textured yarns, the processor should use information available from the Textile Fibers Department—Technical Service Division, of the author's company.

Conclusion

It would be gratifying to be able to state that the foregoing has demonstrated conclusively that Taslan textured yarn truly represents a third major system of textile materials, morphologically and functionally distinct from continuous filament or staple. However, descriptive material can go only so far. The complete story can be told only by presenting a variety of aesthetically attractive and useful fabrics for tactile examination. For the reader to whom such samples are not immediately available, there is other, perhaps equally convincing, evidence. At this writing, more than 40 concerns in the United States and in Europe have been licensed to use the process for making Taslan at various stages of commercialization. These, and their customers, are evaluating Taslan textured yarns for a wide array of end-use fabric types in apparel, domestic, and industrial fields.

Future of Synthetic Liquid and Gaseous Fuels

By 1975 synthetic fuels should play a major role in our energy picture

By Howard R. Batchelder and Harlan W. Nelson[1]

Battelle Memorial Institute, Columbus, Ohio

INTEREST in the field of synthetic fuels has varied in intensity since the latter part of World War II. Immediately after the war it seemed that the rapid development of a synthetic-fuels industry would be necessary to permit the continued expansion of petroleum usage, and extensive exploratory work was started.

However, most oil companies undertook huge expansions of their refining facilities and intensified their exploration and drilling efforts. As a result, production of oil and proved reserves increased and reached the point where, with increased imports, our supply was more than equal to the demand. Under the circumstances, the production of synthetic liquid fuels would be attractive only if it could economically displace petroleum. None of the cost estimates showed that this was the case, and interest in synthetics dropped off.

At the end of the war, natural gas was abundant enough in some localities to encourage its use as a raw material for the synthesis of liquid fuels. As new pipe lines were built, and as restrictions on the use of gas were lifted and new markets were opened, the demand for natural gas rose rapidly; within a few years the question of satisfying an increasing future demand began to assume major proportions.

As with oil, thoughts turned to production of synthetic pipe-line gas by conversion of coal. The technical problems were considered to be surmountable, but again, none of the estimates of cost of production indicated that a synthesis process would be economically feasible.

In considering the future of synthetic liquid and gaseous fuels, it is not proposed in this paper to submit new estimates of the cost of production of synthetics or to make new economic comparisons of the two. Rather, it is proposed to examine the factors that will determine the production of synthetics almost without regard to present price structures.

These factors are the rate of growth of energy demand, particularly for liquid and gaseous fuels, the growth in population, the supply and availability of natural fuels, and the logistics of probable future circumstances.

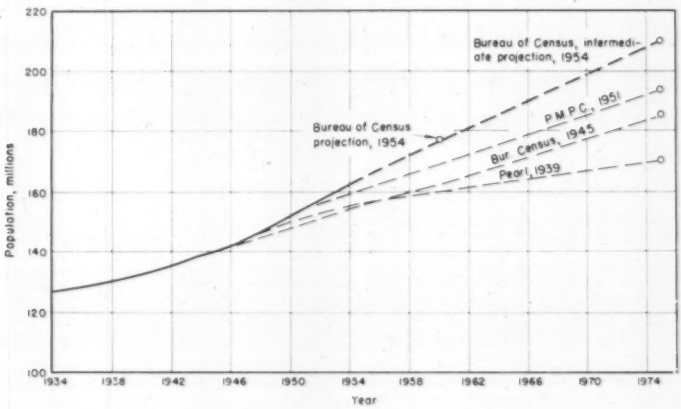

Fig. 1 Population of the United States, 1934 to 1954, and forecast to 1975

Survey and Forecast of Energy Supply and Demand

An increasing supply of energy accompanying improved technologies has enabled the people of this country to reach a standard of living which is higher than that of any nation in the world and to look forward confidently to further elevations of that standard.

For future expansion of the economy, and for national security, the supply of energy must keep pace with the demand. The report of the President's Materials Policy Commission(1)[2] has considered the supply-and-demand factors of our future use of energy as a part of a detailed study of the present and future resources of this country. Others also have reported on the future trends of one or

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Contributed by the Fuels Division and presented at the Joint Fuels Conference AIME-ASME, Columbus, Ohio, October 19-20, 1955. Condensed from ASME Paper 55—FU-3.

[2] Numbers in parentheses refer to the Bibliography at the end of the paper.

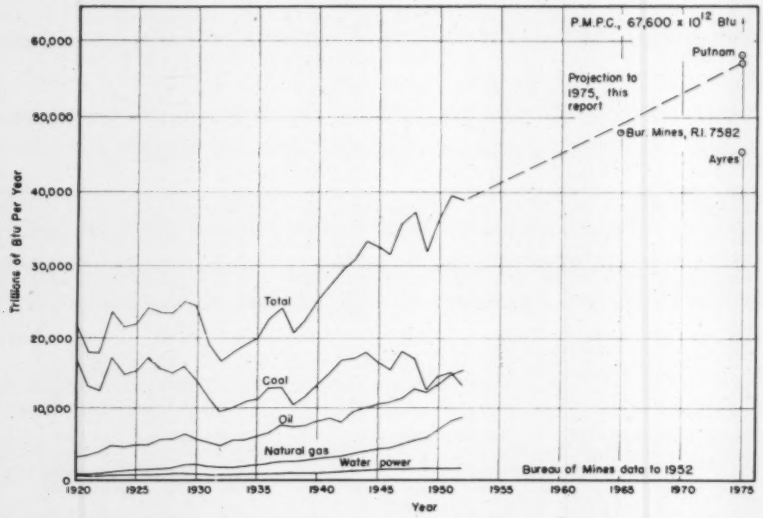

Fig. 2 Annual supply of energy from mineral fuels and water power, United States, 1920 to 1952, and projection of demand to 1975

more of the mineral fuels, in relation to the demands for energy of the future (2–4).

Future Demand for Energy. Two factors of direct bearing on the future economy are the growth of the gross national product, and the growth in population. The gross national product is expected to double during the period from 1950 to 1975.

Fig. 1 shows the growth in population from 1934 to 1954, and the 1954 projection by the Bureau of Census to the year 1975. Earlier estimates of population growth are shown on the graph for purposes of comparison. By May, 1955, the estimated population was 165 million, a figure that, in 1945, was expected by the Census Bureau to be reached sometime later than 1960.

By the latest census estimate, the population of this country will reach 210 million in 1975. This is substantially higher than the 1951 PMPC projection of 193.5 million, and the 1945 Bureau of Census estimate of 185 million. The more rapid rate of population growth will require that more energy than was estimated even a few years ago be available in the future to maintain the standard of economy for the country.

The per capita use of energy during the period from 1920 to 1952 showed a sharp decrease during the depression years of 1930 to 1935, and a recovery during and after the years of World War II. The per capita use increased about 16 per cent over the 32-year period, the total energy use about 77 per cent, and the population 48 per cent. During this period the petroleum consumption per capita increased by 227 per cent and natural gas by 577 per cent; whereas coal showed a decrease on a per capita basis of 48 per cent.

Energy Supply From Mineral Fuels. Fig. 2 shows the trend in the annual supply of energy from mineral fuels and water power for this country over the period from 1920 to 1952. Energy obtained from oil and natural gas shows a steadily increasing rate of usage, with a relatively rapid increase for natural gas during the past several years.

The projection of the total energy-demand curve, as shown on the graph, was made by considering the average rate of growth of per capita usage for

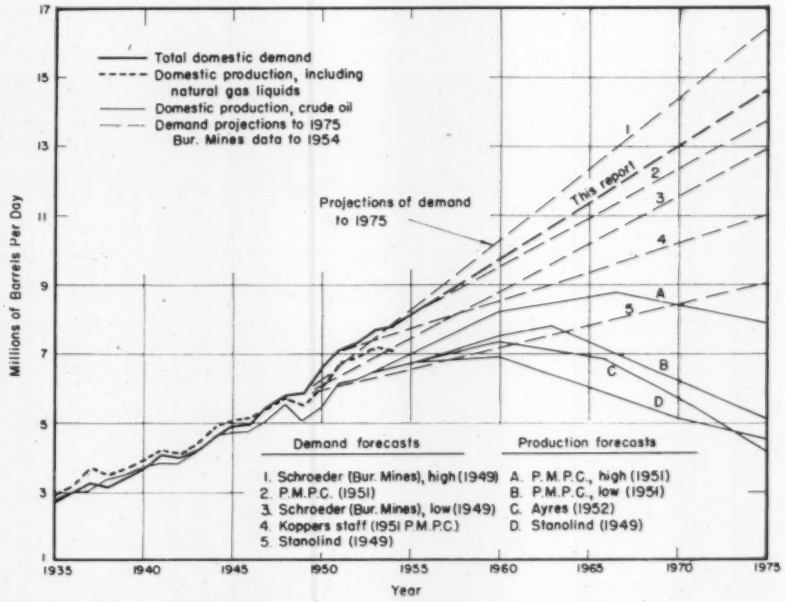

Fig. 3 Domestic petroleum demand and production from 1935 to 1954 and projections to 1975

the period 1920 to 1952 to hold for the years to 1975. With an estimated population of 210 million by 1975, the figure of 57,000 trillion Btu was found to represent the projected total energy demand, an increase of 47 per cent over the supply in 1952.

Atomic Energy And Solar Energy. It has been estimated that within 25 years, one fourth of new power-plant construction will be atomic. W. Kenneth Davis, Director of Reactor Development for the Atomic Energy

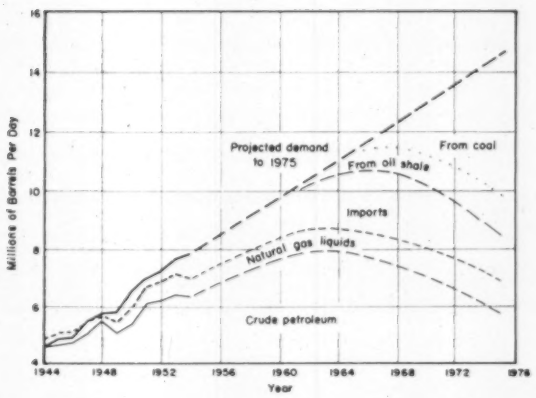

Fig. 4 Projected domestic demand and production for petroleum products to 1975

was made on the basis of using the average rate of rise of the demand per capita over the period of 1920 to 1954 and the estimated population of the country for 1975. Since 1920 the annual demand for petroleum products has grown from a value of 4.28 bbl per capita to one of 17.42 bbl per capita in 1954. It is estimated that this will increase to 25.5 bbl per capita in 1975. With the estimated population of 210 million shown in Fig. 1, a total demand of 14.6 million barrels per day is projected for the year 1975. For purposes of comparison, other projections of the demand curve are shown (5–7).

Fig. 3 also shows the possible trends in domestic crude-petroleum production as projected by several authorities (1, 8, 9). Common to all curves is the increasing separation from the demand curve, suggesting that the production of domestic crude will reach a peak around 1965, and thereafter gradually decline.

Fig. 4 shows the plot of the projected demand curve to 1975, together with a composite of the three highest of

Commission, in a talk before the 17th American Power Congress in April, 1955, gave his estimate of the probable rate of this growth. This was 2 million kilowatts of capability by 1960, 5 million by 1965, 27 million by 1970, and 83 million by 1975.

However, the graph of the total energy extrapolation showed a demand in 1975 of 57,000 trillion Btu per year. The 83 million kw of capability predicted for atomic power, if generating continuously, would amount to 2500 trillion Btu per year, or 4.4 per cent of the total. Actual production would probably amount to 1400 trillion Btu per year, or 2.5 per cent of the total. Our 1952 production of water power amounted to 1600 trillion Btu per year. On this basis, it will be seen that even with a generous forecast of development of atomic power, it cannot noticeably alter the overall energy picture within the next quarter century.

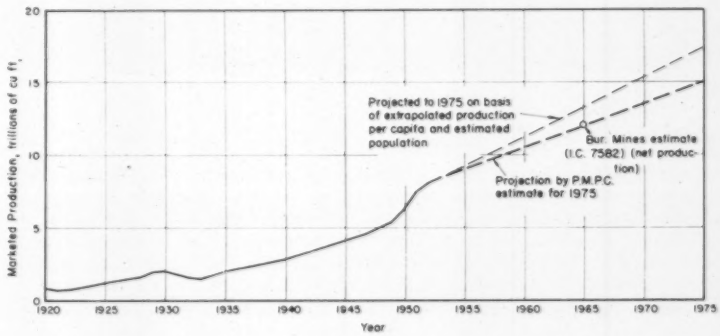
Marketed Production, trillions of cu ft.
Projected to 1975 on basis of extrapolated production per capita and estimated population
Bur. Mines estimate (I.C. 7582) (net production)
Projection by P.M.P.C. estimate for 1975
Year

Fig. 5 Marketed production of natural gas, actual 1920 to 1953, and projected to 1975

The application of solar energy has frequently been spoken of as our ultimate resource. This may well be the case. However, our total energy demands are now at such a very high level that development of any new source of energy must proceed a long way before its contribution to the total is of real significance. It does not seem reasonable, therefore, that solar-energy use, even though it grows at a very rapid rate, can rise to major proportions in the next 20 years.

Survey of Fuels to 1975

Liquid Fuels. Fig. 3 is a plot showing the course of the domestic demand and production of petroleum from 1935 to 1954, from Bureau of Mines data, together with projections of the curves to 1975. Through World War II the domestic production, natural-gas liquids included, was above the curve of domestic demand. Since that time, however, production has lagged behind demand, and imports have made up the deficit.

The projection of the demand curve shown in Fig. 3 the four projected curves for petroleum production shown in Fig. 3. The intermediate dotted line represents the total production of the petroleum products, including natural-gas liquids. For the next five years or so, increased imports will be required to maintain the level of demand shown in the plot. These are shown as reaching a peak value of perhaps 2.3 million barrels per day, holding this for a while, and thereafter declining. Significant increases above this figure do not seem reasonable when considering the ships necessary, the increasing demand for petroleum products on a world-wide basis, and our national security. Before the time of maximum imports, the production of oil from shale should be ready to take up some of the load of the demand deficit.

Shortly thereafter, it would seem mandatory to begin the production of synthetic liquid fuels from coal, by whatever method has been shown most efficient and economical by research and development work in the intervening years. Certainly, by any basis of consideration, it would appear necessary to be prepared to have synthetic-fuel-from-coal plants sometime before 1970, when a large deficit is evident. Even if the ultimate reserves of petroleum in this country are found to be increased substantially, the years of peak production would be shifted to the right only moderately, and the

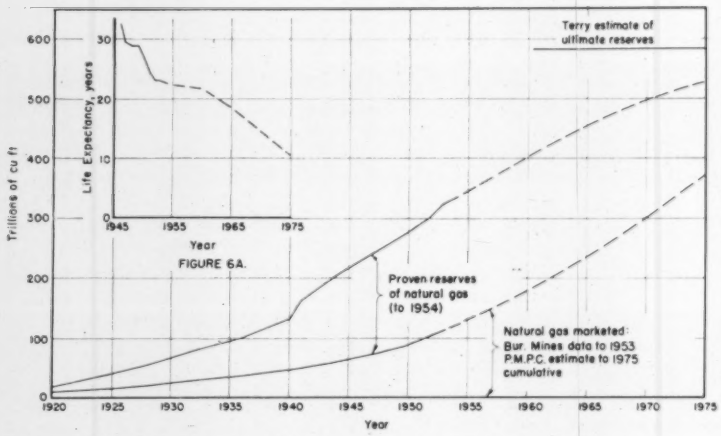
Terry estimate of ultimate reserves
Life Expectancy, years
Year
FIGURE 6A.
Proven reserves of natural gas (to 1954)
Natural gas marketed: Bur. Mines data to 1953 P.M.P.C. estimate to 1975 cumulative
Trillions of cu ft
Year

Fig. 6 Cumulative marketed production and proved reserves of natural gas, 1920 to 1953, with estimates of status in 1975

height of the peak-production curve would be increased by a small amount dictated by conservational practices of production. The need for substantial amounts of synthetic liquid fuels then would be delayed for a few years.

Natural Gas. A "demand" curve cannot be plotted for natural gas, as for other fossil fuels, since production and use can reach only the volume indicated by the capacity of the distribution system.

Fig. 5 is a plot of the marketed production of natural gas during the interval from 1920 to 1953, together with estimates of the possible production and use to 1975. The top dashed line extending to 1975 represents a projection of the production curve made on the basis of the rate of growth of per capita use over the period from 1920 to 1953 and the population estimate for 1975. On this basis the projected marketed production in 1975 would reach a figure of about 17.3 trillion cubic feet. This projection is subject to many conflicting factors with respect to gathering, transportation, and pricing, and to Federal and state regulatory procedures. The estimate of approximately doubled marketed production, 1950 to 1975, made in the report of the President's Materials Policy Committee, is perhaps as reasonable as can be predicted at this time. This projection is shown in Fig. 5 as an extension of the Bureau of Mines data to 1953; its position is slightly below the first curve. An estimate of natural-gas production in 1965 by the Bureau of Mines(4) is shown on the projected curve. This figure, however, is not only for marketed production, but includes losses.

Some appreciation of the possible role to be played by natural gas in the energy system of future years can be had by examining a plot of cumulative production of natural gas and proved reserves. Fig. 6 shows a graph of the cumulative volumes of marketed production and proved reserves for the period of 1920 to 1953, and projections of these curves to 1975. The curves show that by 1953 a total volume of about 114 trillion cubic feet had been marketed and consumed, and that proved reserves as of that date totaled 211 trillion cubic feet.

An attempt is made in Fig. 6 to show a reasonable production-reserves relationship to the year 1975. To do this, the estimate of Terry (10) for the ultimate reserves of natural gas is accepted, and a projection of the curve for proved reserves is based on his estimate, including the rates of discovery for the future. By this estimate, a total of about 500 trillion cubic feet will be available in the future, in addition to the cumulative production volume to date. DeGolyer (11) has arrived at a volume of 400 trillion cubic feet of ultimate reserves to supplement the cumulative production through 1947.

Should the relative position of the curves in Fig. 6 be given credence, the life expectancy for our natural-gas reserves will follow a curve substantially as shown in Fig. 6A. This would indicate a reserve supply in 1975 of ten times the annual consumption at the expanded rate of use. Before that time, either the use of natural gas must be curtailed, or supplementary gas must be brought into use based on synthesis from coal.

Conclusions

Throughout this study an attempt has been made to use conservative and reasonable bases for projection of supply and demand for liquid and gaseous fuels into the future. There seems good reason to believe that production of synthetics will begin quite soon in isolated special cases, and that the general introduction of synthetic fuels will begin within 10 years. The next 10 years after that should see large increases in production capacity, with synthetic liquid and gaseous fuels major factors on our energy picture by 1975.

Coal is the most general and finally the only source of these materials, and as the recovery of petroleum and natural gas declines, the production of coal must rise in proportion.

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Unit Loads for Bulk Materials

Techniques currently used and future possibilities of reducing materials-handling and transportation costs

By E. O. Dean[1] and J. H. Norton[2]

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PRODUCERS and consumers are recognizing opportunities to reduce costs and increase sales through improved distribution techniques. As a result, there are rapidly increasing interest and activity concerning methods of providing unit loads for bulk materials.

The field of in-process materials handling has long since passed through the phase of mechanization and into the application of the principles of automation. The field of distribution is advancing along similar lines. One important area for study is the movement of bulk materials from the point of manufacture to the point of use. The unit load develops from applying the proved materials-handling principle of "combination" to this area of distribution.

We shall review some of the unit-load techniques currently in use. This discussion will be limited to unit loads of intermediate size. Hopper cars, bulk trailers, barges, and the like, will not be covered.

Unit Loads for Packaged Products

Many customers require a package that can be handled manually. When this is true, a method of combining these packages of bulk materials into unit loads will reduce distribution costs to the point where the individual consumer accepts final delivery of the package in his own hands. When the small package is required by the customer, techniques are available which permit combining these packages of bulk materials in an economical manner.

Fig. 1 illustrates the basic approaches to providing unit loads of packaged products:

1 Returnable pallets are very common. They may be the conventional double-faced wooden pallet so common in in-plant materials handling. Returnable pallets may also be of wire, sheet steel, or aluminum construction with or without folding or rigid bodies. They may be of reinforced plastics or other materials. In all cases, they must be strong enough to withstand a number of round trips.

Returnable pallets range in cost from $3 to $20 and in weight from 30 to 125 lb. The primary advantage of these pallets is that they can be handled quickly and efficiently with conventional readily available handling equipment. The high cost limits their use to high turnover operations to avoid excessive tie-up of working capital. The weight of these units limits their use to short-haul situations because of high freight costs on outbound and return trips.

2 Expendable pallets are currently receiving considerable attention. The most commonly used are the simple fiberboard sheet, the lightweight wood or fiberboard pallets with runners and posts, and the paper sling pallet. Expendable pallets range in cost from $0.30 to $2.00 and in weight from 3 to 60 lb. Their light weight reduces the freight cost, and the penalty of return freight on the pallet is eliminated. Limitations are imposed by the cost of the pallet which is a direct increase in operating cost. Reduced handling efficiency and the need for special handling equipment with some types impose further limitations.

3 The palletless unit load of packages is bonded together by steel tape, filament tape, wire, glue, or by combinations of these methods. Runners on which the unit load rests may be wood blocks or even packages themselves. This approach is limited to specific applications where the package is of sufficient size and strength to be self-supporting. Attempts to achieve success with this technique may result in overdesigned and consequently higher-cost packages. The actual construction of the unit load, itself, is usually inexpensive.

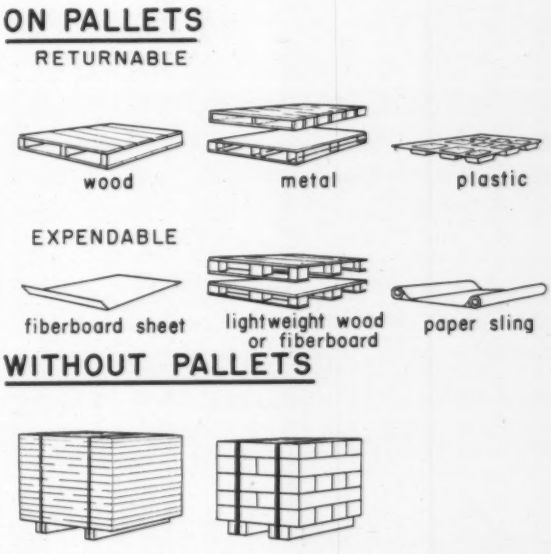

Fig. 1 Basic methods of providing unit loads of packaged products

[1] Supervisor, Materials Handling and Container Group. Associate Member ASME.

[2] Consultant Supervisor. Mem. ASME.

Contributed by the Materials Handling, Railroad, Production Engineering, and Aviation Divisions, and presented at the Diamond Jubilee Semi-Annual Meeting, Boston, Mass., June 19–24, 1955, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

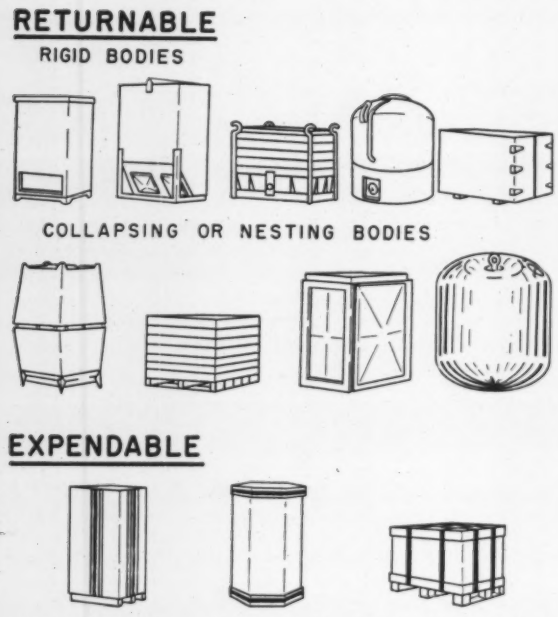

Fig. 2 Basic types of unit-load containers for shipping bulk products

Unit-Load Containers

The unit-load container was originally conceived about 35 years ago as a transportation means to minimize pilfering and freight damage. About 15 years ago a bulk unit container was developed by the authors' company for the shipment of calcium carbide, a classified semi-hazardous material, which resulted in substantial cost reductions. The use of special container cars for these containers resulted in freight-free travel of the containers both ways. Since that time many other applications have been studied.

Fig. 2 illustrates the basic types of unit-load containers currently available:

1 Rigid returnable unit-load containers are made in a wide variety of materials. Bodies may be of aluminum, steel, stainless steel, wood, wire, or plastic. These containers range in size from 50 to 1000 cu ft. Costs vary widely, depending upon materials used and type of construction. Consistently large-volume shipments are generally required for savings to justify the necessary handling equipment. A primary advantage of some types is their ability to be stored outdoors which eliminates warehouse construction. Container weight and size make freight an important consideration. As mentioned, some applications exist where the container has been classified as "freight-free" while freight must be paid on others, either full or empty.

2 Returnable containers also are made which collapse or have nesting or folding parts. These are made of sheet steel, wire, aluminum, wood, and neoprene. Capacities range from 40 to 400 cu ft. The collapsible feature is of particular value when containers cannot be classified for free return freight. For bulk products, the collapsible, as well as the rigid, unit-load container, is only as good as its closure. The design of the filling and discharge openings are of primary importance in the success or failure of the unit-load container.

3 The expendable unit-load container is the newest candidate for consideration in our approach to developing unit loads for bulk materials. Most types currently in use are made of fiberboard. Capacities range from 25 to 50 cu ft; costs vary from $4 to $8 per unit. This type of unit-load container has tremendous appeal to producers and consumers through elimination of return freight. Such containers can be used with conventional readily available handling equipment. These also eliminate the annoyance of container accountability and, furthermore, low turnover does not affect distribution cost adversely.

The expendable unit-load container will assume a position of great importance when units are available that are equal to or lower in cost than the equivalent number of multiwall paper bags.

Selection of Unit-Load Method

The economic factors that must be considered in selecting the optimum unit-load method for a specific product are as follows:

1 Permanent investment
- (*a*) Handling equipment
- (*b*) Filling and discharging equipment
- (*c*) Storage facilities
- (*d*) Containers or pallets (if capitalized)

2 Working capital
- (*a*) Inventory of expendable-type containers
- (*b*) Inventory of product

3 Operating cost
- (*a*) Containers or pallets (if leased or expendable)
- (*b*) Labor and overhead
- (*c*) Freight
- (*d*) Maintenance
- (*e*) Fuel, power, etc.
- (*f*) Depreciation
- (*g*) Interest
- (*h*) Miscellaneous

In addition to these factors, consideration must be given to safety. The unit load reduces the number of exposures to lifting and handling accidents and injuries. Unit-load containers may contribute to improved safety by reducing exposure to dust, fumes, and hazardous materials.

Other advantages of unit loads are improved product protection and easier accountability.

Specific Examples

Expendable Unit-Load Container. One typical study involved the shipment of a bulk product being packaged in multiwall paper bags. Because of the large variety of grades of material involved, the large unit-load containers were impractical. Thus choices were limited to the expendable or the smaller returnable containers. In this case slow turnaround eliminated the returnable unit-load container. Figs. 3 and 4 illustrate the comparison between the handling operations on multiwall bags compared with expendable unit-load containers. The multiwall-bag method involves 40 manual handlings per ton of product at the bagging station and another 40 manual handlings per ton when shipped.

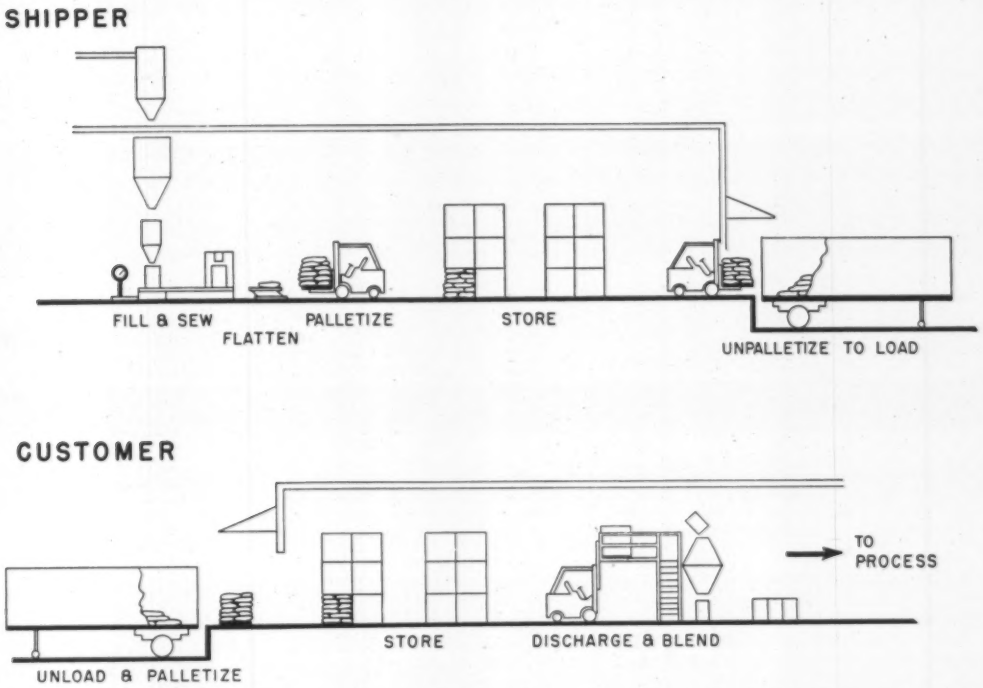

Fig. 3 Typical shippers' and customers' handling operations for products in multiwall paper bags

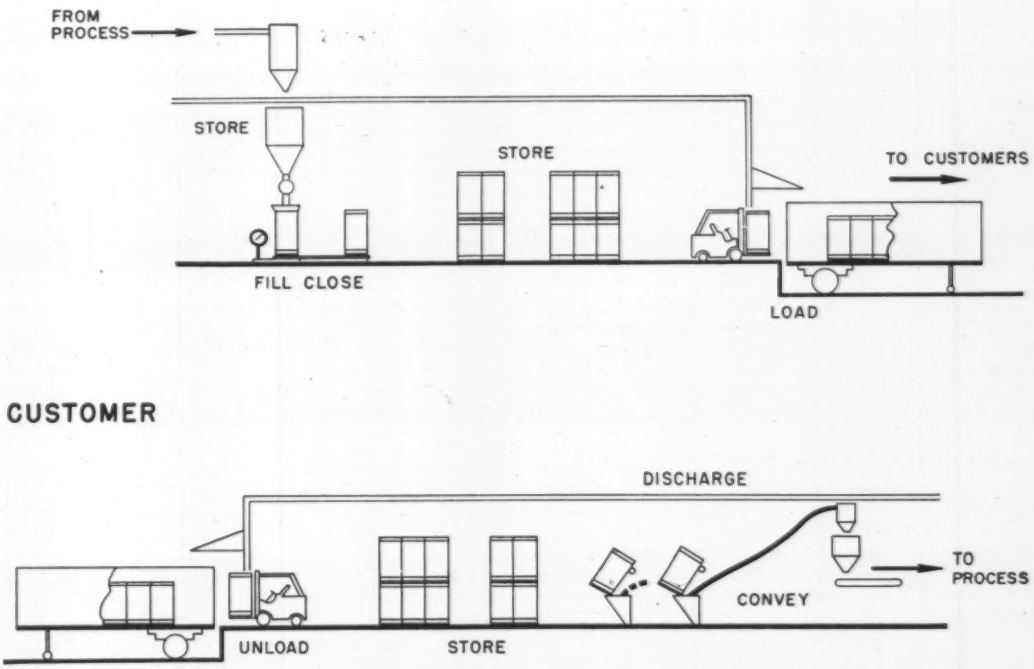

Fig. 4 Typical shippers' and customers' handling operations for products in expendable unit-load containers

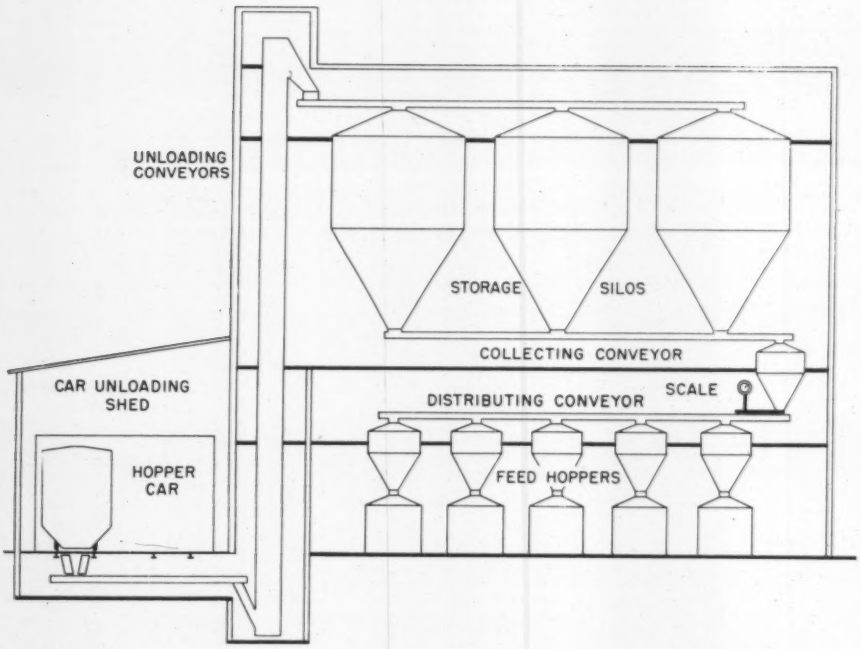

Fig. 5 Typical handling system for free-flowing bulk material shipped in covered hopper car

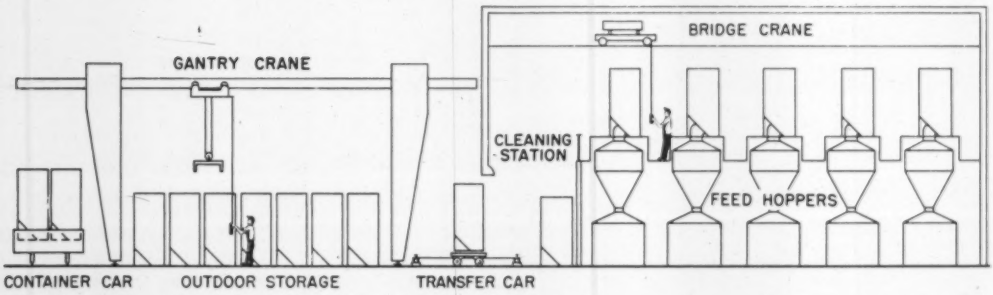

Fig. 6 Typical handling system for free-flowing bulk material shipped in returnable unit-load containers

These operations are duplicated by the customer for a total of 160 manual handlings per ton of product.

Manual handling is eliminated with the unit-load container through the use of mechanical-handling equipment from the point of filling to the point of use. On this basis the expendable unit-load container was the economical choice.

Returnable Unit-Load Container. In another study involving a free-flowing bulk material, investigation resolved itself to a decision between covered hopper cars and a returnable unit-load container. Figs. 5 and 6 illustrate the handling systems involved in the two schemes. The hopper-car method would require underground track hoppers, unloading shed, conveying systems, storage silos, and weighing and feeding mechanisms. The bulk-container method would require cranes for unloading and handling, container-cleaning facilities, and container unloading devices. Although operating costs were essentially equal, the bulk-container method indicated a substantial investment reduction in permanent facilities. In this case the returnable unit-load container was selected.

Future Possibilities

The future of unit loading is promising. There are many situations where the application of unit-loading techniques can reduce distribution costs. Alert users will review their receipt of raw materials and determine where unit loads and unit-load containers can be applied to reduce their costs. Forward-looking suppliers will analyze their position and determine where they can furnish their product in unit loads to greater advantage to increase the market for their products. Talented engineers must become familiar with all phases of unit loading so they may select the most practical method consistent with low cost.

Adhesive Bonding of Metals[1]

By Samuel N. Muchnick

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The strengths of adhesive-bonded metal joints can be made to approach the cohesive strength of the bonding agent if the metal surfaces are treated properly. With one organic adhesive, loads exceeding 7000 psi have been required to break the adhesive bond between samples of stainless steel; 5500 psi for aluminum; 7000 psi for titanium, and 4000 for magnesium. The contact angle which a water drop makes with a treated surface is shown to be an effective tool for evaluating the adequacy of the treatment for metal surfaces. A theoretical basis is presented for the bonding of metals by means of organic adhesives. A study has been made of how nominal joint strength is affected by an adsorbed film on the metal surface and by the mechanical properties of the metal.

THE STRENGTH of an adhesive-bonded metal joint can be made to approach the cohesive strength of the bonding agent, if the metal surfaces have been treated properly. By means of contact-angle measurements against water, the adequacy of the surface treatment can be determined. The contact angle conveniently, and simply, describes the changes in surface properties of the metal resulting from the treatment. And, more significantly, it can be used as a control in industrial applications.

A review of the technical literature on the subject of adhesive bonding of metals indicates that the treatments used in industry for conditioning metal surfaces have been based primarily on empirical discoveries. Although a number of effective treatments for specific metals are in use, no basic understanding of the surface-energy requirements for adequate bonding strengths is obvious in the selection of these surface treatments. Work in the past with hydrophilic and oleophilic surfaces has demonstrated forcibly that an evaluation of these surface energies is a prerequisite to the development of effective surface treatments.[2]

A study was made of the changes in surface properties of aluminum, stainless steel, magnesium, and titanium[3] that have been treated with solvents and acid and alkaline solutions. These changes in surface properties are shown to be related to the contact angles which water makes with these surfaces. By this method an acceptably effective surface treatment (recommended by WADC) for aluminum was characterized, and made the basis for attacking the problems of bonding stainless steel, magnesium, and titanium. During the course of the work, factors other than surface energies were found to influence joint strength. The following symbols are used in the paper: W_a = work of adhesion; W_c = work of cohesion; γ_S = surface tension of a solid; γ_L = surface tension of a liquid; γ_{SL} = solid/liquid interfacial tension; θ = angle that water makes with the solid surface.

[1] Work sponsored by Materials Laboratory, WADC, WPAFB, Ohio.

[2] Unpublished work in the Laboratories of The Franklin Institute.

[3] 24S-T3 aluminum; 302, 1/2 hard stainless steel; FS1-H24 magnesium sheet; RC-130-A titanium.

Contributed by the Rubber and Plastics Division and presented at the Diamond Jubilee Semi-Annual Meeting, Boston, Mass., June 19–23, 1955, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The Theoretical Approach to Adhesion

Work of Adhesion and Contact Angles. The work necessary to pull apart 1 sq cm of solid/liquid interface is given as

$$W_a = \gamma_S + \gamma_L - \gamma_{SL} \quad [1]$$

Correlatively, the work required to break apart a bar of liquid 1 sq cm in cross section in such a way that two fresh 1 sq cm surfaces are made is called the work of cohesion and is given as

$$W_c = 2\gamma_L \quad [2]$$

It can be shown that if W_a is greater than W_c, the liquid will spread over the substrate. The simple relation also indicates that, if spreading occurs, the adhesion between the two surfaces is greater than the cohesional energy of the liquid.

When a liquid does not spread over a solid, but makes a contact angle with the substrate, the work of adhesion can be expressed as

$$W_a = \gamma_L(1 + \cos\theta) \quad [3]$$

It can be seen from Equation [3] that if the liquid makes a contact angle, the work of adhesion is less than the work of cohesion, and failure will occur at the interface rather than in the liquid.

Specifically, from Equation [3], if the free surface energy (surface tension) of a metal surface exceeds the sum of the surface tension of an adhesive and the interfacial tension of the adhesive to the solid, the adhesive will "wet" or spread on the metal surface; i.e., if $\gamma_S > \gamma_{SL} + \gamma_L$, then the spreading coefficient will be positive.

If an adhesive makes a contact angle with the surface, a degree of nonwetting is indicated, and the magnitude of the angle is a measure of the attractive forces bonding the surfaces. The angle can be utilized to determine the effectiveness of a cleaning process on metal surface if a drop of water is deposited on the surface after a cleaning operation. Metal surfaces are known to have high free energies, and water with a surface tension of 72 dynes/cm will spread on these surfaces if they are clear of contamination. We have established that the free surface

Table 1 Test Results With Adhesive-Bonded Metal Joints

Exp. no.	Metal	Treatment no.	Spec. no.	θ (avg)	Adhes. no.	Shear strength, psi — Avg	Max	Min	Control avg	Per cent control
1	Aluminum	As-received	6	67	No. 1	2442	2780	2030	4634	52.7
2	Aluminum	Degreased	6	67	No. 1	2741	3090	2380	4634	59.1
3	Aluminum	A	6	0	No. 1	5173	5430	4858	...	...
4	Al. panels dried in oven	A	6	78	No. 1	3621	3870	3280	4874	74
5	Stainless steel	B	12	10	No. 1	7056	7220	6880	4898	144
6	Stainless steel	As-received	12	50–70	No. 1	5215	6335	3945	4258	122
7	Stainless steel	Degreased	12	67	No. 1	6306	6700	6010	4258	148
8	Titanium	As-received	12	50–75	No. 1	1356	1710	1120	...	...
9	Titanium	Degreased	12	61–71	No. 1	3180	3900	2580	...	...
10	Titanium	B	3	<10	No. 1	6743	7000	6400	...	...
11	Magnesium	C	12	0	No. 1	3842	4092	3608	...	...
12	Stainless steel	Adsorbed water	6	0	No. 1	6641	7153	6346	4469	148
13	Stainless steel	Adsorbed silicone oil	6	67	No. 1	6643	6956	6429	4642	142
14	Stainless steel	Adsorbed toluene	6	...	No. 1	6117	6324	5818	4990	122
15	Stainless steel	Adsorbed paraffin oil	6	...	No. 1	6255	6509	5679	4990	125
16	Stainless steel	B	6	16	No. 2	3378	3485	3278	2450	138
17	Stainless steel	B	6	<10	No. 3	3970	4495	3287	4473	88.7
18	Stainless steel	B	6	<10	No. 4	1943	2237	1353	2180	89.1

NOTES

1 Metals: Aluminum (24S-T3, $^1/_{16}$ in. thick); stainless steel (302, $^1/_2$ hard, $^1/_{16}$ in. thick); titanium (RC-130-A, $^1/_{16}$ in. thick); magnesium (FS1-H24, $^1/_{16}$ in. thick).

2 Controls are aluminum joints A-treated, bonded with adhesive used on test specimens.

3 Degreasing done by immersion for 10 min in trichloroethylene with constant stirring.

4 Shear tests conducted at room temperature.

5 Test joints are bonded 1-in. × 4-in. strips with a $^1/_2$-in. overlap.

6 θ = contact angle between water drop and metal surface.

energies of most common plastic surfaces are less than those of water.[2] Therefore, if water spreads on the treated metal surface, it is a reasonable certainty that the adhesive film also will spread.

The Adsorbed Film and Adhesion. Pure metal surfaces not contaminated with adsorbed gases, vapors, and/or organic films have a high free surface energy; and from the thermodynamics of surfaces should form a powerful bond with the low free-energy surfaces or organic adhesives. However, metal surfaces rapidly become contaminated with adsorbed films resulting in drastically lowered free surface energies and reduced bonding energies. The role of the adsorbed film in bonding procedures, therefore, is a serious consideration. Cleaning and etching treatments can only modify or replace the original adsorbed films, and because of the high free surface energy of the bare metal, and the promiscuity of these attractive energies, the character of the components of the surface treatment is important. One or more of these components will replace the original adsorbed film.

The surface and dimensions of the adsorbed film affects wettability, binding strength, and resistance to weathering. The metal, as received, normally has on its surface an adsorbed hydrophobic film or layer of varying thickness. If this thickness is duplex[4] or greater, the metal surface has the properties of the bulk film. It can be shown that these energies are relatively low compared with binding energies between the adhesive and a hard metal surface. If the adsorbed film is less than duplex, the surface properties of the metal are between that of the pure metal and the bulk film.

To bring the adhesive within the range of the strong attractive energies of the metal, it is necessary to reduce the thickness of the adsorbed film or replace it with a different adsorbed film, also less than duplex (like highly polar water), which apparently enables the attractive energies between the surfaces to be exercised to the fullest.

Metal Thickness and Test Results. The nominal test results with the $^1/_{16}$-in. standard bonded lap joint are not a true measure of the adhesive strength of the joint if the applied load deforms the metal. When metal is stressed, it is deformed elastically. If the stresses are great enough to exceed the yield value of the metal, the material also will flow. As a result of the elastic and flow deformation, a single lap joint cannot be tested in pure shear except when the metal panels comprising it are very thick.

Depending upon the thickness of the metal, strong adhesive lap joints actually fail through four different mechanisms:

(*a*) When the metal is thin, failure occurs by peeling. The strength of the joint under these conditions is a function of the yield value of the metal, and is largely independent of the strength of the adhesive joint. This type of failure is observed with $^1/_{16}$-in. aluminum panels.

(*b*) With somewhat thicker metal panels, the metal yields in tension with the failure starting at the edges of the adhesive joint. When the metal at the edge of the joint stretches, the adhesive bond at the point is broken, thereby permitting the metal deeper in the joint to stretch. This process continues until the joint fails. We have observed this mechanism in practice. When the stresses on the joint are increased steadily, they reach a limiting value and remain constant for several seconds before the joint fails. During this period one can hear the adhesive bonds snapping.

(*c*) If the thickness of the metal is sufficiently great, it will not be stressed above its yield point, and hence

[4] A duplex film is an adsorbed film whose outer surface has the surface properties of the bulk liquid.

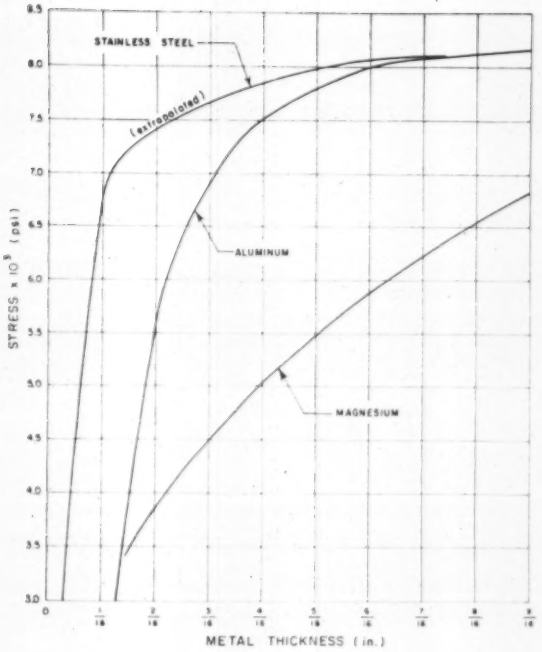

Fig. 1 Metal thickness versus joint strength

will only deform elastically. As a result of this deformation, the metal panels become bowed and cause tensile stresses in the adhesive.

(*d*) When the metal is so thick that the tensile stresses caused by elastic bowing are relatively small, the joint fails in approximately pure shear.

When a series of joints is made up using progressively thicker metal panels, and joint strengths are plotted as a function of thickness of the metal, curves such as those shown in Fig. 1 are obtained. The slope of these curves is not constant but varies with the metal thickness. The curves themselves show that the four types of failure just described cannot be isolated one from the other but merge gradually into each other as the metal thickness is changed. For this reason, a rigorous mathematical treatment of joint strength in terms of metal thickness and mechanical properties is difficult if not impossible.

The curves in Fig. 1 show that when panels of sufficient thickness are used the limiting strength of the joint with both stainless steel and aluminum is around 8000 psi. This is believed to approximate the cohesive strength of the plastic under the specific conditions of curing used. Thus it is shown that the treatments developed for aluminum, magnesium, and stainless steel appear to produce adhesive bonds as strong as the cohesive bonds of the adhesive itself. This analysis is important because it shows that for strong lap joints, the nominal values using $^1/_{16}$-in. metal cannot be used for determining the relative joint strengths among various metals. For instance, with $^1/_{16}$-in. metal and a limiting cohesive strength of 8000 psi for the adhesive, the nominal joint strength with aluminum is 5000 psi, and with stainless steel about 7000 psi, and with magnesium 4000 psi. Yet, the strength of the adhesive bond in each case is equal to, or greater than, the cohesive strength of the adhesive. The single-lap test can, however, be used to show the relative strength of joints with any one metal, using different methods of surface treatment.

Characterization of an Effective Surface Treatment

A surface treatment[5] for aluminum recommended by WADC results in joint strengths greater than 5000 psi. Since these values approximate the yield strength of the $^1/_{16}$-in. thickness of the aluminum, it is likely that the maximum joint strength has been achieved with this metal, Fig. 1. To characterize this surface, experiments were conducted to determine the changes in surface properties of the aluminum at various stages in the treatment. This was done by means of contact-angle measurements with water. These contact angles were measured on the surface as received, following a degreasing with trichloroethylene, and after the A-treatment.[5] If the treatment had removed or destroyed the contaminating film, a large change in contact angle would be observed. A spreading drop (zero angle) resulted from the treatment, and it could be assumed that the hydrophobic contaminating film had been entirely replaced by an adsorbed water film.

This condition of spreading was observed consistently with aluminum surfaces treated with the recommended A-treatment, and was invariably associated with maximum joint strength. This correlation is to be expected in view of the increase in free energy of the surface as the low-energy hydrophobic surface is replaced by the higher-energy water film. It was concluded from these experiments that a basic requirement of a surface treatment for metals is that it condition the surface so that very low or zero contact angles are made against water. This requirement is clearly shown in the results of an experiment in which aluminum surfaces that made zero contact angles were dried in a 250 F oven for 1 hr. After their exposure to the heat, the contact angle rose to 78 F and the joint strength was 3621 psi. The aluminum control specimens[6] that were air-dried in a clean atmosphere had made zero contact angles and had an average joint strength of 4874 psi (Exp. 4, Table 1). This latter is a typical value for aluminum joints bonded with No. 1 adhesive and indicates that curing conditions were normal.

The contact angles on aluminum, as received, ranged from 43 to 80 deg with most surfaces averaging 67 deg (Exp. 1, Table 1). The wide range obviously is due to different types of contamination in handling procedures in the steel mills. The average joint strength for these surfaces was 2442 psi. The degreased surfaces made approximately the same contact angle and had slightly higher joint strengths (Exp. 2, Table 1). These somewhat higher strengths probably are the results of reduction in thickness of both films by partial solution in the solvent. However, this reduction in film thickness produced no change in surface properties. When the A-treatment was used, the water drop spread rapidly on the cleaned surface, and joint strength hovered consistently around 5000 psi.

[5] Details of the three treatments may be obtained by communicating with the author.

[6] The control specimens are aluminum joints pressed with the A-treatment and bonded with the same adhesive used on the test specimens.

Surface Treatments for Stainless Steel, Magnesium, and Titanium

The correlations between joint strength and contact angles on aluminum suggested a similar approach to the problem of bonding metals generally. The agreement with theory of the results with aluminum fully supported this approach. Vigorous chemical treatments of stainless steel and titanium with treatment[5] B resulted in rather complete removal of the contaminating, hydrophobic films from the surfaces, showing approximately zero contact angles with water. The joint strengths with treated stainless-steel surfaces averaged 7056 psi (Exp. 5, Table 1); treated titanium joints gave approximately the same strengths (Exp. 10). Since the mechanical properties of these two metals are quite similar, it was expected that with identical surface properties they would have equal joint strengths when the same adhesive was used. All the tests were made with single-lap joints in compliance with WADC requirements. The stainless-steel joints bonded with surfaces, as received, made contact angles ranging from 50 to 70 deg (Exp. 6), and joint strengths averaged 5215 psi. There was considerable scatter in the data. This is characteristic of joints prepared with surfaces as received. Joints prepared with degreased surfaces made 67-deg contact angles, but have more consistent and high joint strengths (Exp. 7).

The test results with titanium joints showed a large change in joint strength with large changes in contact angles. The material, as received, made contact angles from 50 to 75 deg. These angles did not change drastically when the surfaces were degreased. However, the removal of some of the components of the surface film as a result of solvent action in the degreasing process resulted in a substantial increase in joint strength, increasing from 1356 psi (Exp. 8) to 3180 psi (Exp. 9). When the B surface treatment reduced the contact angles to approximately zero, the average joint strength rose to 6743 psi (Exp. 10).

Magnesium Joints. The attack on the problem of adhesive bonding of magnesium followed the lines used on the adhesive bonding of stainless steel and titanium. Surface treatments were selected that were calculated to remove adsorbed organic films to zero contact angles with water, and, because of the high chemical reactivity of magnesium, the effect on adhesion of inorganic chemically bound films had to be evaluated. If these inorganic films are bound loosely to the pure magnesium surface, or if the cohesive strength of the film is low, the adhesive properties of the magnesium joint will be inadequate. An unsatisfactory bond could result despite a low or zero contact angle. It was expected that zero angles will occur on MgO, $Mg(OH)_2$, $MgCO_3$, and other magnesium compounds which form on the surface.

Following a number of exploratory experiments, a treatment was found which resulted in a surface that made a zero contact angle and was free of loose inorganic film, (treatment[5] C). The average joint strengths were 3842 psi (Exp. 11, Table 1). This value conforms closely to the calculated joint strength based on the yield strength of the metal.

Other Factors in Bonding Metals

In the course of this work it was found that factors other than the proper conditioning of the surface influence nominal and actual joint strength. When the single-lap joint was used to test the adhesive strength of a metal bond, and relatively high stresses were required to break the joint in tensile shear, the mechanical properties of the metal determined the maximum gage reading of the tester. For example, $^1/_{16}$-in-thick aluminum specimens broke at 5000 psi, stainless steel at 7000 psi, magnesium at 4000 psi, and titanium close to 7000 psi. These treated surfaces made zero angles with water drops, and the same adhesive was used in bonding the metals. We concluded therefrom that in evaluating the maximum strength obtainable it is necessary to consider the mechanical properties of the test metal. Experiments were conducted with aluminum, stainless steel, and magnesium of different thicknesses to determine the relationship of the metal thickness to the nominal joint strength. The results of the investigation are shown in Fig. 1. It is obvious therefrom that when strong adhesives are used on surfaces that have been conditioned suitably the nominal joint strength is a function of the mechanical properties of the metal. In addition, the following factors were investigated:

1 The chemical nature of the adsorbed film.
2 Oven drying and air drying of treated surfaces.
3 Effect of hardness of rinse water.
4 Adhesive-film characteristics.

In the study of the adsorbed film on stainless steel, it was found that the thickness rather than the chemical nature of the film is important. Joints were prepared with stainless-steel surfaces that had adsorbed either water, silicone oil, toluene, or paraffin oil, and the joint strengths showed no significant variation (Exp. 12–15, Table 1).

Negligibly small changes were observed after 2 hr when the heated surfaces were dried in relatively clean air or in a heating oven in a clean atmosphere. However, substantial decreases in joint strength were noted when the drying was done in an oven in shop atmosphere.

Rinse water up to a hardness of 200 ppm did not affect the surface properties of joint strength of heated metals.

We found that the thickness and homogeneity of the adhesive film are significant. The presence of bubbles in the film resulted in lower joint strength and considerable scatter in data.

Four different adhesives were used with identically treated surfaces, and it was seen that the joint strengths vary with the adhesive (Exp. 5, 16, 17, 18, Table 1). It was not possible to determine in the limited time spent comparing the adhesives whether the difference in joint strengths with the various adhesives was due to differences in their mechanical properties or to specificity of the bonding agents.

Conclusions

It has been shown that with a given adhesive, the highest joint strength and greatest reproducibility result when the metal surfaces are cleaned rigorously. The thoroughness of the cleaning treatment can be determined by means of the contact angle made by a water drop against the surface. Also, it has been seen that a treatment which renders one metal surface suitable for bonding will not necessarily prepare another metal surface adequately. Furthermore, it has been demonstrated that the chemical nature of the film on a metal surface is not as significant as the thickness of the film, and that procedural techniques significantly influence the strength of an adhesive-bonded joint.

Bending and Impact Tests . . .
of Cast-Iron, Cast-Steel, and Nodular-Iron Valve Bodies

Commercial standard 6-in. valve bodies were tested in bending at 900 F and under drop-impact tests at 40 F. Results indicate that ferritic iron valves possess sufficient shock resistance and ductility to avoid brittle fracture under these conditions.

By J. O. Jeffrey[1] and R. H. Hanlon[2]

THE current specifications of ASME Boiler and Unfired Pressure Vessel Codes 1952 (1)[3] limit the use of valves, flanges, and pipe fittings made of class B cast iron (2) to pressures below 160 psi, and to temperatures under 450 F. For conditions in excess of these, either high-test cast iron or steel is required. The physical and mechanical properties possessed by a relatively new material, nodular cast iron, appeared to be sufficiently attractive to merit an investigation of the behavior of valve bodies made of nodular cast iron in certain applications where steel is presently required. Nodular iron's superior resistance to the corrosive action of certain fluids also contributes to its consideration as a desirable material for valves and pipe fittings.

The present work was undertaken to make a preliminary evaluation of nodular-iron valve bodies as compared with cast iron and with cast steel under impact forces at 40 F and under a steady bending stress at elevated temperatures (900 F). The effect of quenching under the latter conditions was also investigated.

Materials Tested

Tests were conducted on standard 6-in. flanged gate-valve bodies made of three different materials: gray cast iron, nodular cast iron, and cast steel. The chemical analysis of each is given in Table 1.

The compositions of the steels and cast iron in the valves tested lie within the limits specified by ASTM in A216WCB and A126 Class B specifications. The composition of nodular iron has not yet been adopted by ASTM.

The gray-cast-iron valve bodies were selected at random from the regular routine production. The steel bodies were obtained by disassembly of two standard valves purchased in the open market. These valves had been in service but had no physical or mechanical defects. Since both gray cast iron and cast steel are standard materials for valve bodies, the specifications for chemical composition and physical and mechanical properties have been specified by ASTM, and the ASME Boiler and Unfired Pressure Vessel Code. It is therefore not necessary to report properties for these materials, as they conform to the established specifications.

Nodular cast iron, however, is a relatively new material, for which no specifications have been written by the ASME Boiler Code Committee, and for which the ASTM specifications are only tentative (A339–51T). For this reason the following detailed information is given regarding the specific material in these valve bodies. The choice of chemical composition and microstructure for these nodular iron valves was made on the basis of data reported by numerous writers (3, 4, 5, 6, 7, 8, 9) concerning the effect of composition and microstructure on the behavior of the material under impact loads. Table 1 gives the chemical composition, while the photomicrographs in Fig. 1 show that the materials can be classified as a ferritic nodular iron. The matrix of the nodular-iron valve used in the bend test was entirely ferritic; the drop weight test nodular-iron valve had about 10 per cent pearlite. This structure which provides the maximum machinability, toughness, and ductility, was insured by annealing the as-cast valves for 6 hr at 1300 F. Tensile tests of 0.505 in-diam specimens of this material gave 54,000 psi yield strength, 72,000 psi tensile strength, 20 per cent elongation in 2 in., and 155 Brinell hardness number. Records from the foundry which cast these valves, covering their consecutive daily production for one month (23 heats), showed the following average values with minimum and maximum values given in parentheses for tensile properties:

Yield strength, 59,250 psi (52,750–65,000)
Tensile strength, 72,500 psi (66,750–79,000)
Elongation in 2 in., 19.75 per cent (17.19–23.44)
Brinell hardness, 149 (143–159)

The foregoing information is given as an index of the limits within which it is commercially practical to produce cupola-melted, annealed, ferritic, nodular cast iron. No tests were done to determine the effect of temperature on these properties, and no creep data have been obtained for this particular nodular iron. However, since it is typical of other ferritic nodular irons as reported by the ASM committee on nodular iron in *Metal Progress* (10), it would be reasonable to assume that its behavior would be similar to that reported for ferritic nodular irons having the same tensile strength and hardness. Reference (10) affords an excellent guide to such engineering characteristics as fatigue, impact, elevated-temperature properties, etc. Additional elevated-temperature properties of duc-

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[3] Numbers in parentheses refer to the Bibliography at the end of the paper.
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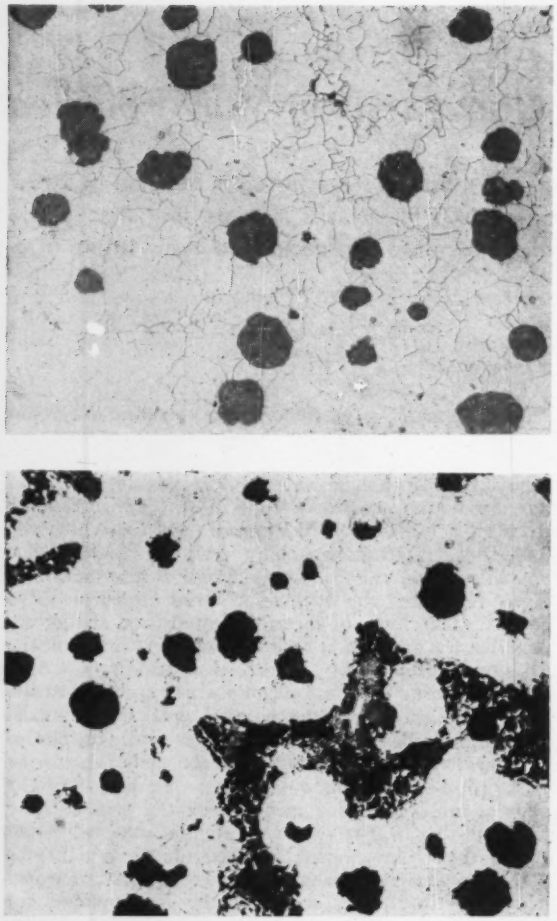

Fig. 1 Bend test, *top;* photomicrograph (×100) of nodular iron specimen removed from the valve body used in the bending tests. Drop test, *bottom;* photomicrograph (×100) of nodular iron specimen removed from the valve body used in the drop tests.

tile cast irons have been reported recently by Wilks, Matthews, and Kraft (3).

In the interests of economy, the nodular-iron valve bodies were cast from the same patterns as used for gray-cast-iron bodies. Shrinkage in the fillet between the flanges and neck of the valve caused a recess at their juncture: the fillet radius was not normal to the flange face and neck. This was corrected by building up this radius with wax on the pattern, and making the flange $^1/_{16}$ in. thicker. No other changes in the pattern were made. The ordinary machining work was done on the valve, so that it conformed with the dimensional specifications for standard 150-lb flanged valves. Comparing the finished valve body with one made of gray iron, it was noted that the wall thickness at the neck of the nodular-iron valve body averaged 0.710 in., while those in gray iron averaged 0.625 in. Since both are cast from the same pattern this difference must be caused either by differences in shrinkage characteristics or by molding methods. The machine molding for the gray-iron valves results in harder ramming of the sand and the pattern

Table 1 Chemical Analysis of Gray Iron, Nodular Cast Iron, and Cast Steel

Test	Steel		Cast Iron			Nodular Iron	
	Bend	Drop	Bend	Bend	Bend	Bend	Drop
Carbon	0.31	0.28	3.74	3.52	3.37	3.55	3.61
Silicon	0.24	0.33	1.82	2.15	2.05	2.35	2.19
Manganese	0.75	0.60	0.55	0.70	0.70	0.40	0.40
Phosphorus	0.036	0.023	0.154	0.161	0.178	0.071	0.070
Nickel						1.61	1.26
Sulphur						0.018	0.016
Magnesium						0.061	0.062

is not rapped. Hand molding was used for the nodular-iron valves. The two steel bodies varied considerably in wall thickness: at the neck, the valve used in the drop test averaged 0.800 in.; for the bend test the neck averaged only 0.430 in.

Drop Impact Tests

Several studies have been made to investigate the impact resistance of nodular irons by the use of Charpy, Izod, and special test bars. Substantial data (4, 5, 6, 7, 8) are available to study their values, and from them, to evaluate the effect of various chemistries, microstructures, heat-treatments, and melt methods on transition temperatures, and will not be reviewed here.

The impact data on full-sized specimens are limited. The Pellini, Sandoz, and Bishop paper (4) relates their tests on the impact properties of various materials using large plates and Charpy bars.

One object of their work was to establish the significance of Charpy data to brittle behavior in service for cast and rolled steels and for nodular cast iron. Briefly, their conclusions of this aspect were: Charpy values averaging between 3 to 8 ft-lb correspond to the temperature at which the drop weight nil ductility transition occurs without deformation in the presence of a sharp notch. Regardless of the energy level, these materials do not develop brittle failures above this temperature. "*The top of the shelf of the Charpy V energy differences is of significance only to the cases of failures related to a slow tearing process and not to the essentially instantaneous catastrophic failures related to the general problem of brittle failure.*"[4]

In the interest of developing the relative toughness of valve bodies of the same size and type made of cast iron, nodular iron, and cast steel, the following test was arranged:

The valve body to be tested was placed on its side, the edges of all three flanges resting on a large massive flat surface, serving as an anvil. The latter consisted of a cupola furnace bottom about 4 ft in diam, and 12 in. thick at the center. A skull-cracker ball weighing 2840 lb was dropped on the valve.

Previous experience had determined that this ball had to be dropped more than three feet on a 6-in. cast-iron gate-valve body to consistently produce fracture.

The first drop of the ball from 10 ft shattered the cast-iron valve as shown in Fig. 2.

At an ambient temperature of 40 F, three drops of the ball were made from 35 ft on a 6-in. nodular-iron valve body, the ball striking substantially between the flanges. No cracks were found after these three drops.

At this time the body was placed end down, so as to strike the body end to end. Two drops were thus made,

[4] Italicized by authors.

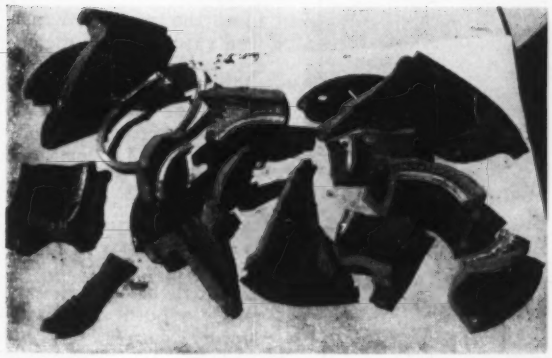

Fig. 2 Result of one drop of skull-cracker ball from a height of 10 ft on a 6-in. 125-lb flanged cast-iron gate-valve body

Fig. 3 A nodular iron 6-in. 150-lb gate-valve body, rough casting, after sustaining five drops from 35 ft of a 2840-lb skull-cracker ball

also from 35 ft, and the test was stopped because of the extreme hazard created by the unpredictable "cue-ball" flight of the body. On this last test, an off-center drop resulted on the body flying 20 ft through the air.

A careful examination of the body revealed a crack in the strut joining the flange to the wall of the body.

Fig. 3 shows the body after test. This nodular-iron body had not been machined because it had bulged flanges, and would not fit the seating machine or facing-machine jaws, and had been scrapped.

To get a comparison with cast steel, the test was repeated using a 6-in. cast-steel gate-valve body, and dropping the ball 3 times from 35 ft on the side of the valve and twice from the same height striking the valve end to end.

Fig. 4 shows the resultant damage to this cast-steel body. It suffered a total of six cracks, the most surprising of which were those in the belly of the body remote from any machine work, cracking in smooth, unbroken walls in three places.

The cracking and tearing of the bonnet flange can be somewhat explained by the fact that this body had been drilled and machined, whereas the nodular iron was an unmachined casting. But the belly of neither body was machined and here a fair comparison may be made.

The wall thickness of the ductile iron and steel valve bodies averaged 0.75 in. and 0.80 in., and weighed 115 lb and 131 lb, respectively.

Bend Tests

The setup for the bend tests is shown in Fig. 5. It consisted of two heavy I-beams, each about 20 ft long, on one end of which was welded a standard 6-in. forged-steel 150-lb welding-neck flange with the $^1/_{16}$-in. raised face removed. The valve body to be tested was bolted to these flanges. For elevated-temperature tests a sheet-metal shield on either side of the valve body served to confine the heating. The supports were fabricated of structural steel, and located equidistant from the loading pans. Cast-iron pigs, each of which was previously accurately weighed and marked, were used for loading the system. During loading, equal weights were added simultaneously in both pans, thereby producing a uniform bending moment along the beam and valve body between the supports. For each test, the distances between the pans and supports were carefully measured, and the weights added to each pan were recorded. Subsequent to the

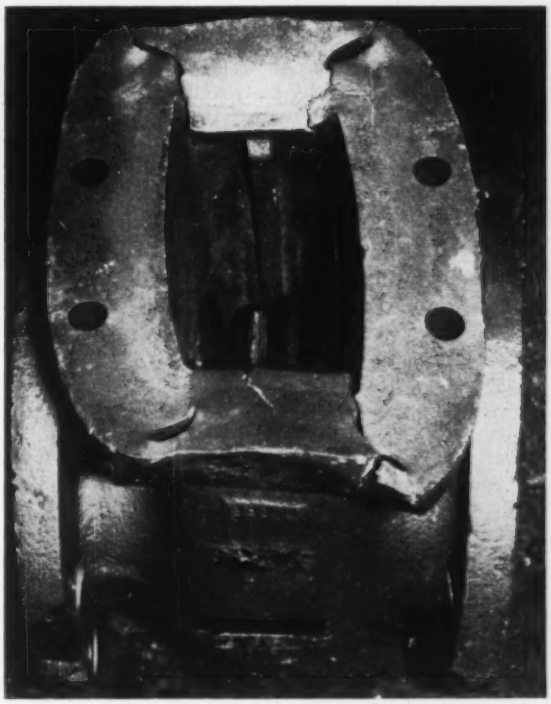

Fig. 4 Top view of cast carbon-steel valve body, after dropping 2840-lb skull-cracker ball a total of five drops from 35 ft

Fig. 5 Valve bend testing machine (beam type) actuated by deadweighting, capacity of 1,000,000 in-lb

tests, the pans and the I-beams were weighed, and the centers of gravity of the latter were located.

A portable oil burner was used for heating. The temperature of the valve body was observed at five widely separated points, and the heating was directed so as to maintain the same temperature reading at each of these locations. Thermocouples were inserted from the inside of the valve into $^1/_4$-in-diam holes drilled through the valve wall; the wires were led out through the valve-bonnet opening to a direct-reading pyrometer.

The First Cast-Iron Bend Test. The first test was conducted on a cast-iron valve body to determine the bending moment required to break it at ordinary temperature. Brittle fracture occurred, without perceptible distortion of the valve, when the loads applied to the pans produced a bending moment of 17,500 ft-lb on the valve. The fracture is illustrated in Fig. 6 and is characteristic of all the fractures on cast-iron valve bodies, regardless of temperature.

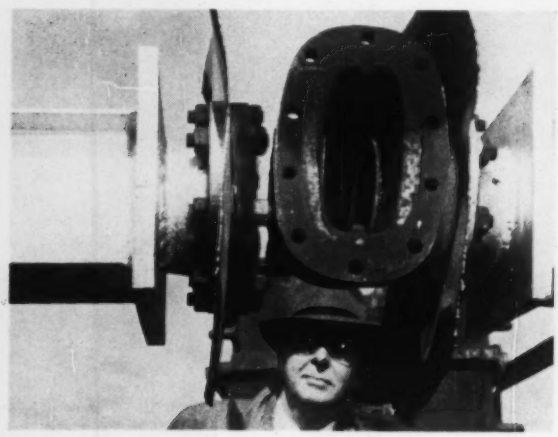

Fig. 6 Close-up showing typical brittle fracture of cast-iron valve body

The Second Cast-Iron Bend Test. The second test on a gray-cast-iron valve body was conducted to determine the bending moment required for fracture at elevated temperature. After heating the body to a uniform temperature of 900 F, equal loads were applied to both pans until rupture occurred. Failure was identical with that of the preceding test, occurring at a bending moment of 15,200 ft-lb. While this load is 13 per cent lower than that of test No. 1, it is not possible with only one set of results to evaluate how much change is due to the effect of temperature on properties, and how much actual variation in material, wall thickness, etc., contributed to the change. It would probably require testing at least ten valves at both temperature levels to determine statistically the effect of elevated temperatures on the bending moment for fracture.

The Third Cast-Iron Bend Test. The third test on a cast-iron valve body was performed to determine the effect of drastically cooling the valve with a stream of cold water after heating the valve to about 900 F. It required approximately 15 min of heating to reach 850 F, after which a bending moment of 9850 ft-lb was applied. Sufficient heat was applied to maintain the temperature during loading. Quenching under this load had no effect. Reheating to 850 F, increasing the bending moment to 12,300 ft-lb, and quenching produced no effect. After reheating to 850 F again, the valve broke when the bending moment reached 14,100 ft-lb, without quenching. From these results it was apparent that the thermal stresses induced by quenching were relatively insignificant, and the variations in the material and in the dimensions from valve to valve, all being within specified tolerances, would cause greater variations in the bending moment at fracture than would be produced by quenching. Since fracture must occur when the induced stress reaches the strength of the material, it is logical that quenching from 900 F cannot significantly increase the induced stress with the form of loading which is applied in these tests as the beams are entirely free to move.

The deadweight loading system maintains a known constant load during quenching and thermal readjustments. It was for this feature that this loading method was selected. Thus, if quenching causes a minor contraction, the external forces remain constant, because the loading beams move closer together by an infinitesimal amount.

Since the 900 F temperature chosen for these tests was well below the critical temperature, no change in the microstructure or in the mechanical properties could occur in ferritic nodular iron by drastic cooling from temperatures below 1400 F (11). Hence the only effect

of quenching would be to induce thermal stresses, and as the previous testing of cast iron demonstrated a negligible effect from thermal stresses in this setup, it was concluded to test the nodular-iron body without quenching.

Furthermore, this particular valve body had already been subjected to a fire test in which it was heated over a pool of burning oil for 23 min, reaching a temperature of 1250 F from which it was quenched with water from a fire hose. No known external load was imposed on the valve for the foregoing test. The valve suffered no distortion, and subsequently passed a 450-psi hydrostatic test. As was done in test No. 2 on the cast-iron body, the temperature was elevated to 900 F, and maintained at this level during loading, to failure of the top pair of bolts. While there was but little perceptible distortion of the valve or its flanges, the standard $^3/_4$-in. B-14 alloy steel bolts stretched and bent so much that the loading pans were lowered to the ground. After replacing the top pair of bolts on both flanges with $^7/_8$-in-diam (B-14 alloy steel) the test was repeated. The fracture shown in Fig. 7 occurred after considerable permanent deformation of the valve body under a bending moment of 73,400 ft-lb. As illustrated, Fig. 7, most of the distortion was on the right-hand side of the valve at the top in tension. The wall thickness measured 0.700 in. and was fairly uniform all around the throat on the right side; on the left, a shift of the core caused a wall thickness of 0.740 in. on the tension side, and only 0.680 in. on the favorably located compression side. This explains the nonuniform distortion. It should be emphasized that the tear originating in the neck adjacent to the flange did not proceed completely around the valve; in other words, it was not the sudden brittle fracture of ordinary gray cast iron. The distortion of the oversize bolts shown in the picture is also significant.

Cast-Steel Bending Test

A standard 6-in. cast-steel valve body was tested next at 900 F following the previously established procedure. It was assembled with two pairs of $^7/_8$-in. bolts on the top of the flanges where the tensile stresses prevail.

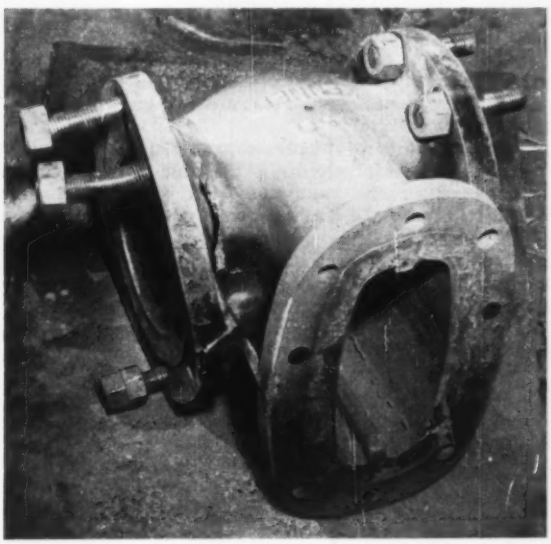

Fig. 7 Close-up of nodular-iron valve body showing fracture

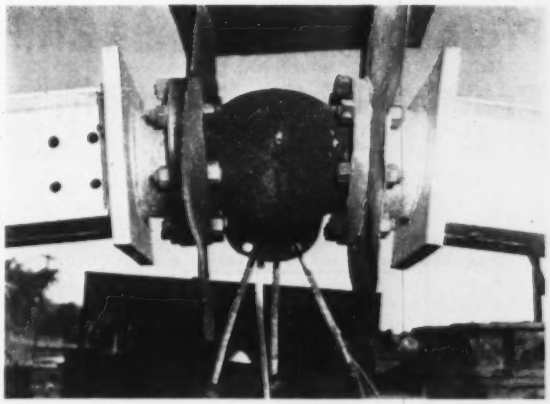

Fig. 8 Close-up of cast-steel valve under test (having absorbed full deflection limit of testing machine)

While there was no actual separation of metal in the valve body, its distortion was so severe that the loading pans were ground at a bending moment of 55,500 ft-lb. This extreme distortion is illustrated in Fig. 8 which clearly shows how much the radius of curvature at the top and bottom of the valve differ. The wall thickness at the necks on the tension side of this valve measured only 0.400 in. and 0.410 in. Comparing this figure with that of the ductile-iron valve body (0.700 in.) indicates that the section modulus of the latter was about 80 per cent greater than the modulus for the steel body. While the higher section modulus obviously accounts for greater load-carrying capacity in bending, it also would tend to limit the amount of distortion permissible before a fracture occurred. Thus it might be assumed that with a thinner wall on the ductile-iron valve body its behavior would approach that of the steel, and show greater permanent deformation at lower bending moments.

Table 2 Summary of Bending Tests

Material	Temperatures, deg F	Maximum load
Cast iron	70	17,500
Cast iron	900	15,200
Cast iron	900	14,100
Cast steel	900	55,500
Nodular iron	900	73,400

Summary and Conclusions

Drop-weight impact tests at ordinary temperature and slow bend tests at 900 F were conducted on standard 6-in. gate-valve bodies made of ferritic nodular iron and of Class B cast iron and cast steel for comparison of performance. The latter materials were the standard commercial products; the nodular iron was heat-treated to insure a ferritic matrix with less than 10 per cent pearlite, and silicon and phosphorus were held to the lowest limits consistent with commercial production, in order to minimize the embrittling effects previously reported for these elements.

From these tests the following conclusions may be drawn:

1 No brittle failure was obtained under impact at 40 F for the cast-steel or the nodular-iron bodies. Under repeated drop-weight tests, the damage to the nodular-iron valve body was less than that to the cast-steel

(Continued on page 30)

Professional Aspects of the Practice of Engineering

By Russell G. Warner

Chairman, ECPD Recognition Committee, and Chairman, EJC-ECPD Joint Committee on Practice of Engineering

"Professional responsibility for engineering work is a personal responsibility and that personal responsibility should be recognized by all laws relating to the registration or licensure of the professional engineer. Therefore the person or persons in responsible charge of professional engineering practice must be legally registered professional engineers and there should be no discrimination by implication, omission, or direction as to the form of business organization, individual, partnership, corporation or other." ***Statement proposed by EJC-ECPD Joint Committee on Practice of Engineering.***

THESE remarks will necessarily repeat many statements made in the Committee reports and Annual Meetings of Engineers' Council for Professional Development during the past twenty-three years. I trust that these repetitions will be considered as added emphasis. I would like to start my remarks by asking, "Why did you become an engineer? Was it primarily to serve your fellow men? or did you consider it an opportunity to earn a living?"

Undoubtedly most of us sought an opportunity to earn a living, and considering our abilities and aptitudes, engineering looked like a good vocation.

How many of us thought of engineering as a profession when we planned our preparation? Probably very few; yet we have been active in our committees and in our societies considering ways and means of enhancing our professional status. I believe this is not only desirable but essential in promoting the solidarity of our profession.

What Is a Professional Man?

It is well to review from time to time what constitutes a professional man. Different persons have used various words but the basic thoughts are similar. Wickenden said it is a matter of spirit and scope. Vannevar Bush says the professional man should minister to the people with dignity and authority.

Our ECPD Training Committee has stated this very well: "It is impossible to over-emphasize the fact that technical competence is the *necessary* but not the *sufficient* condition for becoming a professional engineer. There must be developed, in addition, certain personal characteristics, qualities of personality and of character, which will establish unmistakably a feeling of trust, confidence, and loyalty in man-to-man relationships."

Twenty-five years ago an editorial in *Civil Engineering* stated: "The engineer who considers his *calling* to be a *profession* will be interested to learn the obligation he has assumed to justify so high a status. A professional man must, of course, possess special knowledge and skill and the ability to exercise them but, of equal or greater importance, he must possess altruistic characteristics and he must conform rigidly to a code of ethics of a high order."

The importance of high ethical standards has been admirably discussed at the present meeting. It is apparent that we should repeatedly familiarize ourselves with the Code of Ethics and follow it. Perhaps we should ask, "Are we truly professional in our attitudes, in our relations with our employers, our employees, our clients, and with the public in general?" Each of us should take back to our associates some of the idealism expressed here so that each engineer in his own organization will become more than ever a credit to our profession.

We must always keep in mind that we guide the professional development of the younger man in our organization by example more than by words. This has been expressed as "catching through contact and contagion."

The teachers of engineers have a responsibility and a challenge to so inspire the students that they in turn will develop high professional attitudes. The discussions at this meeting were most reassuring and I would that all our faculty personnel were of the same conviction as those participating.

Most of us are from the States, and may not be familiar with the spiritual emphasis of professional attitudes engendered in the young engineer by our Canadian friends through the Kipling ritual and the ceremony of the Iron Ring. Upon graduation from an engineering school the Iron Ring is presented to each graduate who in turn agrees to an "Obligation" which includes the spirit of our Canons of Ethics.

Responsibility of Employers

In looking over this group, it would appear that many of you are employers or supervisors of young engineers. It was pointed out this morning that ethical relations are fully important for employers and employees. What are you doing to develop each young engineer in your jurisdiction? Are you accepting a definite responsibility to develop a truly professional man? Are you assisting to provide the best environment so that he will develop and be a credit to our profession?

Address delivered at the 23rd Annual Meeting, Toronto, Ontario, Canada, October 13 and 14, 1955, of Engineers' Council for Professional Development. (Slightly condensed.)

There is much you can do to guide him and to improve his opportunities for advancement. Encourage him to broaden his perspective. Minimize the amount of routine duties and, in so far as possible, present opportunities for him to do creative work and assume responsibility. Assist him in learning more about other portions of your business so that he can see how his duties are integrated with those of others to make the whole picture.

Perhaps you can guide him in his reading and in his continuing education so that he may be prepared to progress to larger duties. If further formal education is desirable, attempt to arrange work schedules so that he can take desirable courses. Such courses might be in technical fields or in other fields, for example, public speaking or certain aspects of getting along with people. In some cases financial assistance for formal courses may bring worth-while returns.

You can help him to get started in participating in engineering-society activities. He should be advanced in grade of membership as he qualifies for such advancement. Encourage him to identify himself with our profession through becoming an engineer-in-training and, after sufficient experience, through registration as a professional engineer. Be sure that he understands that every professional engineer should be registered.

It is desirable to discuss with him his development, his shortcomings, and his strong points. Keep in mind that as this young man develops professionally, he should become a more valuable employee. The young engineer must help himself, but I urge that we older men do what we can to create a stimulating environment.

It seems hardly necessary to emphasize the importance of the individual in a profession. It is the personal education, knowledge, skill, and judgment that is fundamental to professional practice. Just as it is the composite ideas of individuals that establish the achievements of the engineer, it is the composite ideals of individuals that establish the tone of our professional standing. Group projects are dependent on these characteristics in the individual persons in responsible charge.

Importance of Registration

We are prone to compare engineering with the professions of medicine and law. There are many similarities in the requirements of education, skill, and experience, and in ethical standards. Also, with professional registration the legal status is now comparable. But we must recognize certain differences. In the professions of medicine and law practically every member has an individual professional relationship with his client. In our profession most engineers are employees, and the engineers serving clients as individual professional engineers are very much in the minority.

There are the engineers engaged by manufacturers; there are engineers employed in various phases of government operations; there are engineers engaged by the owning and operating corporation to design and construct power systems, chemical plants, mining and metallurgical plants, and the like, and there are engineers serving in a consulting capacity.

In a report of a recent survey[1] by a committee of the National Society of Professional Engineers there was listed the classification of some 2400 engineers replying to a questionnaire on various phases of engineering registration. Just now I am interested in the groupings shown. This report showed 25 per cent of the replies from those in the consulting field, 15 per cent in government employ; the others were in such fields as manufacturing, utilities, teaching, and the like. Although 90 per cent of those were registered as professional engineers, it is generally recognized that less than half of the total number of engineers are registered. Therefore this indicates that the number of engineers in the consulting field is probably in the order of 10 to 15 per cent of the total.

It is this group of consultants which most nearly represents the personal relationship of the professional man and his client that we find in the medical and legal professions.

Practice of Engineering by Corporations

Most of the problems of the doctor or the lawyer require the services or skill of one or of a very few members of his profession. On the other hand, frequently engineering problems are so complex that many engineers, with a diversity of knowledge and skill, are required to work closely together to arrive at an over-all solution.

It is logical then for groups of engineers to become associated together for consulting practice. Some engineers form partnerships and others prefer the corporate form of business. There are many firms of each type. Should engineers have the freedom to follow their professional activities through the type of firm of their choosing? All engineers do not agree on the answer.

Some say, yes. Some feel that the corporate form of business seriously detracts from our professional standing. Others fear that the corporate form may permit others, who are not engineers, to form policy, possibly to the extent of overruling the judgment of the engineers. Some propose to overcome this latter objection by specific requirements; such as, that all officers, or all the directors, or in the extreme that all the stockholders, be professional engineers. Although this latter view is held by several leaders of consulting-engineering corporations, there are many who feel that such restrictions are unnecessary and undesirable from the standpoint of economic service to the public.

One factor stems from the fact that there are numerous firms, usually corporations, which combine certain engineering services with construction contracting or with products, which further complicates the picture. For example, certain firms will contract to write specifications, design, construct, and turn over to the customer a complete plant. This is often referred to as the "turn-key" plan.

In general, manufactured goods are sold at a price to include the engineering. Take for example the complexity of the engineering in an automobile. A large number of engineers combine their skills to design the cars and other engineers develop the machines to produce them. Because it is the usual or common practice for the manufacturing corporation to hire professional engineers as its employees to design its products, most will agree that this practice is not objectionable.

One of my friends has said that "the ethics of the engineer employed by a corporation are necessarily those of

[1] *American Engineer*, August, 1955, p. 15.

the corporation." There may have been cases where the ethics of the engineer have been in conflict with those of the officers of a corporation. But it seems reasonable to me that the officers of a corporation will be interested in developing and maintaining a standard which will produce future business. Is the incentive to cut costs or do a questionable engineering job any greater in a corporation than in a partnership? Is it a fact that engineers who work for a corporation have lower professional standards?

In referring to doctors and lawyers it might be pointed out that an increasing number are now salaried employees of large industrial corporations. Again there are clinics of doctors incorporated for research and practice of medicine. Hospitals, in which the practice of medicine is by qualified doctors, are commonly incorporated and usually have several laymen for directors, and it is not infrequent that the chief administrator is not a doctor. Are such doctors and lawyers less ethical or less professional because of their association with corporations?

In the report of the Committee on Recognition presented earlier in the program it was recognized that engineers are practicing their profession through the corporate form of business. In view of the facts two questions were raised:

"1 How can effective control of the practice of engineering be provided with due regard for the need for more than one qualified individual in some engineering operations and with assurance that the person practicing is not disembodied or lacking in qualification; and

"2 How can the historic rights of all 'persons' legally practicing engineering be retained within 1?

"The many discussions to date indicate that there is general agreement on these two, although there is great disagreement on methods, and even on side issues which are considered by some to be part of the argument. Thus there appears to be a belief in one quarter that an individual is per se ethical, while a corporate body is per se not ethical. There is indication that some feel that ethics can be defined by legislation, and that the threat of punishment will generate ethical practice, by individual or corporation."

The progress report of the EJC-ECPD Joint Committee on the Practice of Engineering also presented at this meeting emphasizes the importance of the individual:

"Professional responsibility for engineering work is a personal responsibility and that personal responsibility should be recognized by all laws relating to the registration or licensure of the professional engineer. Therefore the person or persons in responsible charge of professional engineering practice must be legally registered professional engineers and there should be no discrimination by implication, omission, or direction as to the form of business organization, individual, partnership, corporation or other."

In closing I would like to again emphasize that, whether teachers, employers, or employees, whether we work for ourselves, for a partnership, or for a corporation, may we as individuals exemplify the high ideals of our profession; and may each of us do his part in creating the climate in which the oncoming engineers will further develop these professional ideals and promote the solidarity of our profession.

Bending and Impact Tests . . .

(*Continued from page 27*)

body.[5] Cast iron shatters brittlely under relatively low impact.

2 The load-carrying capacity of the ductile-iron valve at 900 F exceeded that of the cast-steel valve. In the former a tear was initiated after considerable permanent deformation, but the fracture did not propagate. The cast-steel valve body suffered so much plastic distortion that the test could not be carried to fracture. Cast-iron valves fail catastrophically with no perceptable permanent deformation at significantly lower loads in this test.

3 The water quenching of cast-iron valves from 900 F under load did not induce failure from thermal stresses in these tests. It was therefore concluded that this treatment would not affect other materials if the heating temperatures were below the critical. The physical properties of ferritized nodular iron of the composition used for these tests are not affected by drastic quenching until the temperature exceeds 1400 F.

4 Although more exhaustive testing is obviously necessary, the performance of these nodular-iron valve bodies under the severe conditions imposed indicates that ferritic nodular iron of the proper chemistry may be expected to perform over the same temperature range as well as or even better than commercial cast steel.

Acknowledgments

The authors wish to acknowledge the assistance of G. L. Cox of The International Nickel Company, for his valuable suggestions, A. E. Shobeck, president of The Jamestown Malleable Iron Corporation, whose foundry supplied the material used in the nodular-iron tests, and to B. F. Shepherd of the Ingersoll-Rand Company, who very generously provided data on the effect of quenching ferritic ductile iron.

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11 Private communication, July 28, 1954, from B. F. Shepherd, Ingersoll-Rand Company, Phillipsburg, N. J.

[5] Since this work was done, the previously described drop-weight impact test was conducted at 25° F on a commercial cast-steel valve body and on a ferritized nodular-iron body of the type reported here. Fracture was initiated in the steel body after two impact blows on the side of the valve. The ductile iron valve withstood four blows on its side without fracture, after which two blows were required on the end of the valve to start a crack.

[6] From ASTM Special Tech. Pub. no. 158, 1953.

Briefing the Record

Abstracts and Comments Based on Current Periodicals and Events

J. J. Jaklitsch, Jr., *Associate Editor*

Automatic Steel-Strip Thickness Control

Closer, continuous control of cold-reduction mills producing sheet and strip products has been made possible by an x-ray gage system developed through the co-operative efforts of the United States Steel Corporation and the General Electric Company. After adequate tests and experimentation, this system is now operating on a five-stand tandem cold-reduction mill at U. S. Steel's Irvin Works at Dravosburg, near Pittsburgh, Pa.

This new installation is the first over-all thickness control in the steel industry to utilize not only a screwdown control to vary reduction on the first stand but also a vernier system operating on the roll speed of the last stand. With this arrangement, thickness variations in the finished product can be held smaller than was ever possible by manual means.

A unique feature of the regulating system is that it is completely free of vacuum tubes and was designed on the basis of transistor and magnetic-amplifier techniques and components.

Control of the No. 1 stand screwdown originates in an x-ray gage between stands No. 1 and No. 2. The gage is suspended from a retractable carriage with the x-ray unit below the strip and the detector unit above the strip.

The desired thickness of the steel sheet to be cold-reduced is set on a dial of the gage to select a reference signal. The actual thickness of the steel is then measured by the x-ray gage and the difference from the desired thickness is brought to the automatic control panel in the form of an electrical signal. This signal activates a transistor discriminator in the automatic control which observes the direction of the error, whether heavy or light, and also the degree of error.

The discriminator emits a polarized d-c signal which is fed into an on-and-off time circuit containing magnetic amplifiers. On-timing is a function of the magnitude of the deviation signal available. If the steel leaving stand No. 1 is 0.5 mil off gage, the screwdown motors will run for a shorter time than if the steel is 0.7 mil off gage.

This permits the screwdowns to run less frequently

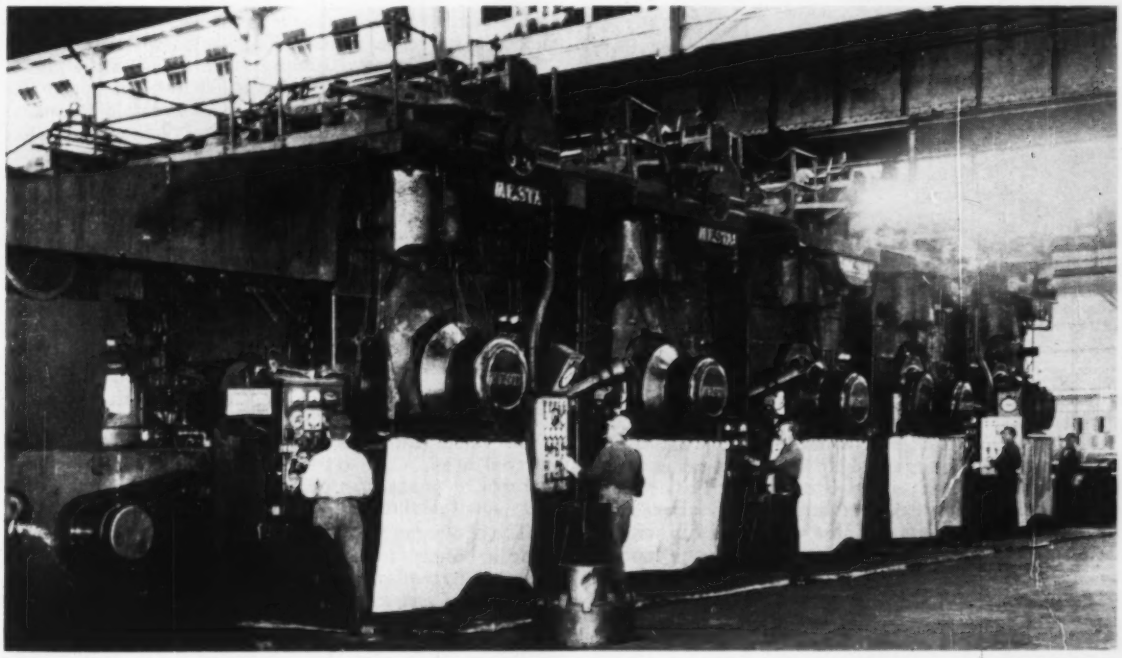


Fig. 1 This five-stand tandem mill at U. S. Steel's Irvin Works which is operated by an automatic gage-control system was developed on a co-operative basis with General Electric. The system produces uniform strip steel at 4000 fpm.

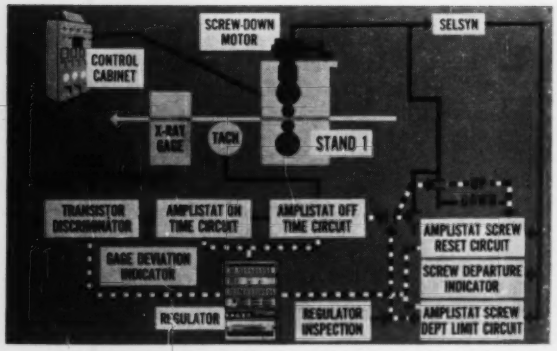


Fig. 2 Automatic x-ray gage control (coarse system) as set up between stands No. 1 and 2

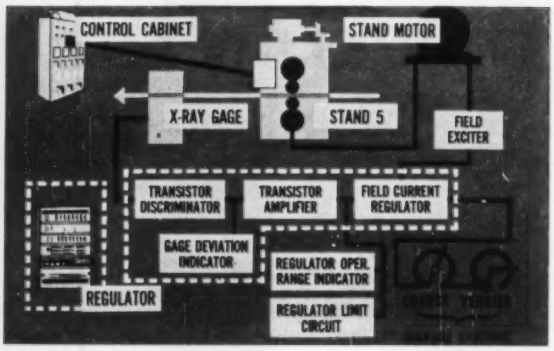


Fig. 4 Automatic x-ray gage control (vernier system) as set up at stand No. 5

Fig. 3 U. S. Steel employee watches an x-ray thickness gage dial for variances beyond specified tolerances for fast-moving strip on five-stand tandem mill in background. The x-ray unit is part of automatic gage-control system.

to bring the strip or sheet within tolerance than if a constant on-time were provided.

The off-time circuit is provided to permit the steel to travel from the rolls of stand No. 1 to the x-ray gage position before the regulator activates any further operation of the screwdowns. As the strip speed varies over a wide range, the off-timing must vary inversely with the strip speed. The deviation signal, after being modified by the on-and-off time circuits, operates the up and down relays of the No. 1 stand screwdown motors. The screwdown motors run in the required direction to correct the steel thickness and to maintain within close tolerances the desired thickness of strip leaving the first stand.

Operation of the x-ray gage control system on stand No. 1 screwdowns reduces large thickness variations to small variations. The small variations are further reduced by the operation of the product-thickness regulator on stand No. 5.

The stand No. 5 mill motor receives its power from a common source which is supplying power also to the other stands of the drive. The motor field has a current regulator consisting of an exciter and an amplidyne with both coarse and vernier rheostats controlling the excitation. Therefore speed of the fifth stand can be controlled in relation to previous stand motor speeds and thus adjust the thickness of material leaving stand No. 5 by varying the tension between stands Nos. 4 and 5.

An x-ray gage similar to the one used between stands No. 1 and 2 measures the thickness of the strip leaving stand No. 5 and being wound on the reel. Here again the desired thickness is set on a dial of the x-ray gage to select a reference signal. This is compared with the thickness of the steel leaving stand No. 5 and a signal proportional to the difference is fed into the automatic control as a deviation signal. This signal is again fed into a transistor discriminator which observes direction and amplitude of the signal. The polarized signal from the discriminator is increased by a transistor amplifier to a power level suitable for the field current regulator.

In actual operation, stand No. 5 is set up manually by the operators by means of the screwdowns. The coarse and vernier settings of the motor-field current regulator of the gage system are then set to approximately the desired output thickness. The automatic control system then operates over a range of ± 5 per cent speed to control product thickness to the desired value. Changing the speed of stand No. 5 in relation to that of stand No. 4 changes the draft and tension on the strip between these stands and thus controls the thickness of the delivered steel. The control system is continuously in control of product thickness and makes corrections for very small deviations.

The new x-ray gage control is designed not only to provide a better product for the consumer and minimize waste due to off-gage material but to augment the skill, experience, and knowledge of the roller and to relieve crew members of the monotonous and exacting chore of continuously adjusting manual controls. It allows the crew to direct their attention to the other important functions in the operation of the cold-reduction mill.

Anthracite-Coke Blends

A BLEND of 40 per cent anthracite and 60 per cent coke from bituminous coal has been used successfully for making pig iron in an experimental blast furnace at Pittsburgh, Pa., according to a recent Bureau of Mines report. This points to a possible new market for the hard-pressed anthracite industry. It also represents the highest percentage of "hard coal" used in such an operation in modern times, the Bureau commented, pointing out that the anthracite portion seldom has exceeded 10 per cent of the fuel charged to a commercial blast furnace, and then chiefly during coke shortages.

The recent tests at Pittsburgh were made with iron ore from Minnesota's Mesabi range.

While economic factors were not considered during the runs, Bureau researchers commented:

"It appears that further experimentation might develop a combination of furnace design and raw materials that would make smelting of iron ore with anthracite commercially attractive.

"The generally favorable results of these tests should encourage experimentation with the increased use of anthracite in locations where this fuel is competitive in cost with coke."

A detailed report on the test runs also noted:

"If, in a period of hostilities, a sudden increase in demand for steel should develop or coke ovens were destroyed, the country might have to depend to a very large extent on the use of anthracite in blast furnaces."

The Bureau tests were part of a broad research program authorized by Secretary of the Interior Douglas McKay and designed to develop new uses for anthracite.

Anthracite was one of the first fuels that replaced charcoal in American blast furnaces. In 1874 nearly half the country's pig iron was produced in anthracite-fired furnaces. After 1880, however, construction in the Pittsburgh area of larger blast furnaces operating wholly on coke led to a rapid decline in this use of anthracite.

During the tests in the experimental blast furnace, good-quality pig iron unusually low in sulphur was made without difficulty with anthracite-coke ratios up to 40 to 60, and there was little difference in operation with any proportion of anthracite to this point.

The experimental blast furnace, although having most of the characteristics of a modern commercial furnace, is not a scale model, and not enough time was available for these preliminary tests to permit study of all the variables. For this reason, the Bureau notes, the maximum anthracite-coke ratio that would give satisfactory performance in a commercial operation would have to be determined by tests run in a full-sized furnace.

Single copies of R. I. 5165, "Smelting Iron Ore With Anthracite; Bureau of Mines Experimental Blast Furnace," can be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa. It should be identified by number and title.

Oxygen Converter

THE Bessemer converter, which made steel available in thousands of tons instead of by the pound, marked the start of the steel age. Today, steel men are watching a new converter development—the oxygen converter.

Although not widely used in the United States, the process is the subject of considerable discussion and experimentation. According to *Steel Facts*, December, 1955, one steel company in the middle west began using the process early in 1955. Two others plan to build converters.

Briefly, Bessemer steelmaking consists of blowing air through the bottom of a bricklined vessel through molten pig iron. Oxygen in the air burns out unwanted quantities of certain elements so as to produce steel. The whole iron-to-steel cycle takes about 20 min, compared to 8 hr or more to produce steel in an open-hearth furnace into which cold scrap and molten iron are charged. For a variety of reasons, however, the open hearth—with its cold scrap-molten iron charge—is by far the most widely used furnace in the industry today.

The new oxygen converter substitutes high-purity oxygen (98 per cent or better) for air, and blows it at

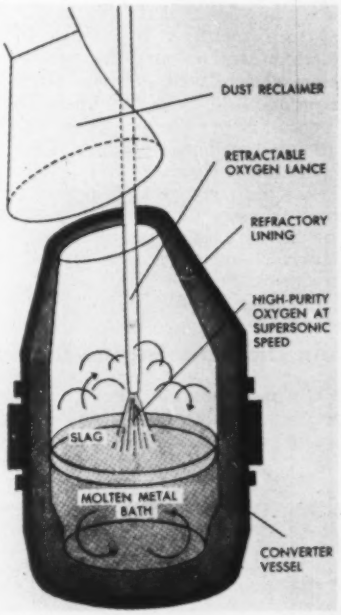


Fig. 5 Diagram of major parts of oxygen converter. Distance from tip of lance to bath varies with each converter installation.

supersonic speed onto the top of the molten-metal bath. Features of the process are said to include: Steel with properties similar to those of basic open-hearth steel, versatility in rapidly producing small tonnages of various grades—and steel low in nitrogen—(0.003 to 0.007 per cent).

Bessemer steel had certain advantages over open-hearth steel for some applications; these included ease of machining the steel when made into wire, bars, and special shapes.

Nitrogen in steel is much like seasoning in food. The right amount in the right place can be most desirable, but too much in the wrong place is undesirable. High-nitrogen content may cause low-carbon steel to become brittle and fail during processing.

Consequently low-carbon steel with high-nitrogen content is considered unsuitable for many applications requiring extensive working, forming, or deep drawing.

Since the nitrogen content of oxygen-converter-produced steel compares favorably with that of open-hearth steel, steelmakers are carefully following the development of the process. One user reports that the new process cuts production costs through lower fuel costs. Only added fuel used is the oxygen, at considerably less cost than open-hearth fuels. Oxygen units can produce about three times as much steel per day as the average open hearths. In addition, the converters can use as much as 30 per cent scrap steel per heat. This is not so high a percentage as can satisfactorily be charged into an open hearth but is well above the 7 per cent maximum for conventional Bessemer converters.

In the United States, an abundant supply of good ore and the availability of scrap have permitted the open hearth to become the work horse of the industry. Bessemer capacity has declined sharply in the last few decades. And open hearths will continue to produce the bulk of American steel for some years to come.

But steelmakers are well aware of the advantages of pneumatic production—high output at low cost. And tonnage-oxygen plants are proving to be valuable adjuncts to steel-mill equipment. The "new-look" converter—the oxygen converter—is due for more attention now that high nitrogen is avoidable. With the nation's steel industry planning still further expansion of its ingot capacity, steel producers will be taking a long look at the claims and records of all technical developments in steelmaking.

Aluminum Die-Cast Engine Blocks

Production of aluminum die-cast engine blocks has been accomplished successfully by the Doehler-Jarvis Division of National Lead Company, according to Frank J. Koegler, vice-president of National Lead Company and general manager of Doehler-Jarvis.

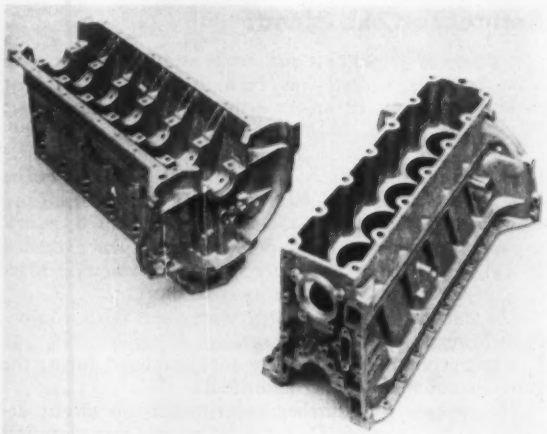


Fig. 6 Top (*right*) and bottom (*left*) views of world's first aluminum die-cast six-cylinder automobile engine block

The straight-type engine block weighs approximately 50 lb as it comes from the die-casting machine and 43 lb when trimmed, and represents the largest die casting ever made in aluminum. The same engine block in gray iron would weigh approximately 175 lb. Therefore, by using aluminum rather than gray iron and by reducing the wall thickness in the aluminum engine block, immediate weight savings of 132 lb are realized.

The new block has been produced on an experimental basis at a Toledo, Ohio, plant of Doehler-Jarvis on the world's largest die-casting machine. This machine can handle dies weighing up to 50 tons. These two developments resulted from a joint project of National Lead and the Kaiser Aluminum and Chemical Corporation.

An aluminum engine block would show an approxi-

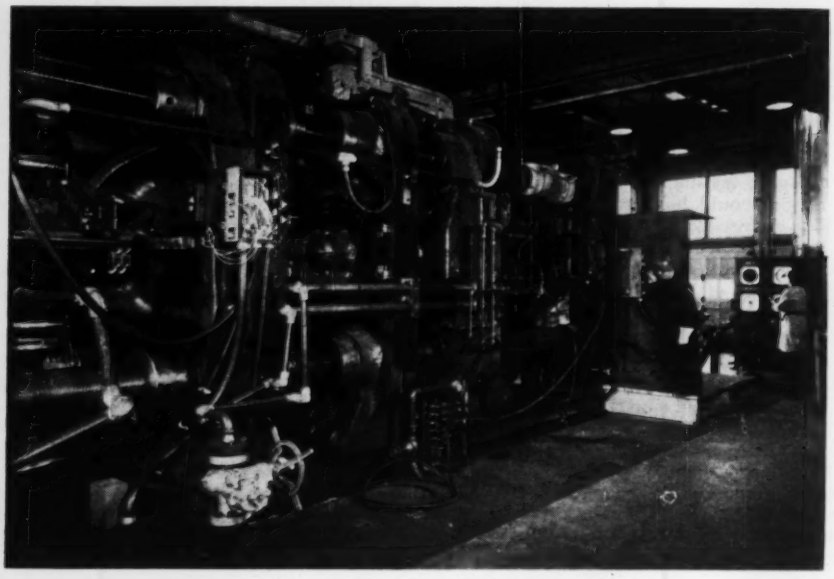


Fig. 7 Pictured here is the 72-in. die-casting machine used in producing the six-cylinder aluminum automobile engine block from an experimental die. This machine, the world's largest, weighs 250 tons and can handle dies weighing up to 50 tons.

mate 10 per cent price advantage over the conventional gray-iron block, Mr. Koegler pointed out. The die-cast block needs far less machining than the gray-iron block, because the machining is confined to the main sealing areas.

The heat conductivity of aluminum is much higher than that of gray iron, and an engine block in aluminum would therefore require a less complicated cooling system. The smooth surface of aluminum die castings prevents the occurrence of uncontrollable sections and sand pockets restricting the flow of cooling water, a common problem found in gray-iron engine blocks.

The new engine block can be produced at a rate of 30 to 35 pieces per hour on a single machine, according to A. F. Bauer, chief engineer of Doehler-Jarvis, who has been in charge of its development. At this rate approximately 1700 lb of molten aluminum are used per hour.

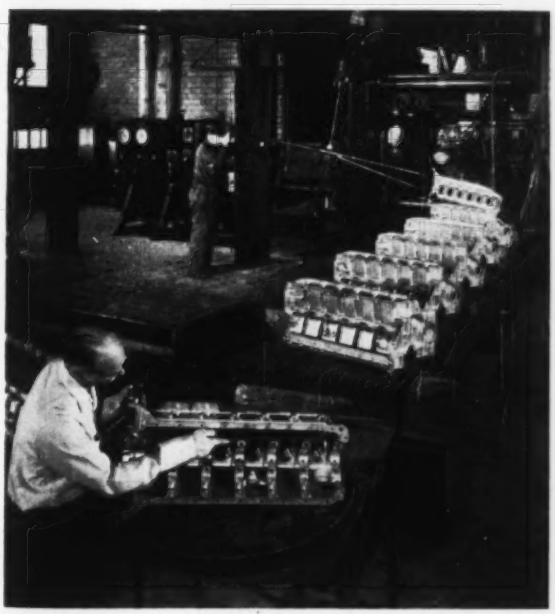


Fig. 8 Six-cylinder, die-cast aluminum motor blocks, first of their kind, come down conveyer in a Doehler-Jarvis plant in Toledo, Ohio. The die-casting machine is in background.

He added that all the 129 holes are cored and cast to size—not a single hole has to be drilled in the block. The die-cast blocks will undergo intensive testing and are expected to stand up under the stresses and requirements as well as the conventional gray-iron blocks.

Based on experience of Doehler-Jarvis engineers with the six-cylinder engine blocks, development of a V-8 aluminum engine block which will weigh between 70 and 75 lb is under way.

New Soldering Technique

A NEW technique which permits soldering such materials as aluminum, stainless steel, glass, and ceramics without special equipment has been developed by the University of California's Los Alamos Scientific Laboratory. The method is expected to effect great savings over the ultrasonic method the Laboratory has been using, and to be of particular interest to aircraft and electronics industries, home-workshop hobbyists, etc.

Besides the usual soldering materials, the new method requires only a hand grinder with an abrasive wheel. The technique was discovered during a research project on the use of ultrahigh-frequency sound waves in soldering, and ironically involves doing something that apprentice mechanics are taught not to do.

To solder these previously unsolderable materials, the grinder is turned on and the abrasive wheel (preferably preheated by grinding metal or the use of heat) is brought to bear on a soft solder such as Wood's metal or 60–40 lead-tin. The soft solder melts and flows onto the surface of the wheel, "loading" it and incidentally making it useless for its customary purpose until it has been trimmed down. The solder-loaded wheel is then applied to the surface to be soldered until a slight amount of abrasion has taken place, using the pressure one would ordinarily use in grinding. The heat of friction again melts the soft solder, which flows onto the freshly abraded surface and forms an intimate contact.

After this tinning operation, soldering is done in the usual manner with standard 50–50 lead-tin solder. The other surface is also given the new treatment if it is a material not ordinarily "wetted" by solder. No soldering flux, surface cleaning, or pretreatment is used.

When working with such materials as soft glass, pyrex, and ceramics, the best tinning is accomplished with a mixture of Wood's metal and 50–50 indium-tin. However, when soldering glass to glass or ceramic to ceramic, it is necessary to use flame or furnace heating to get enough heat to the surfaces to be joined.

The two surfaces need not be of the same material: Metals, soft glass, pyrex, and ceramics may be soldered in any combination. A satisfactory grinding wheel has been found to be a medium grit, $^1/_4$ in. diam $\times$ $^1/_2$ in. long, although the type and size are not critical.

Engineers—Top Managers

THE engineer rapidly is replacing the lawyer and the banker in top-management positions in industry, according to Dr. John T. Rettaliata, Mem. ASME, president of Illinois Institute of Technology, Chicago, Ill.

Speaking at the annual meeting of the American Society of Safety Engineers in Chicago, Dr. Rettaliata said that as policy problems grow more complex the engineer is being called upon to assume functions beyond the scope of engineering.

He cited a survey to the effect that 40 per cent of today's industrial management is engineer-trained.

Dr. Rettaliata asserted that the trend toward increasing managerial responsibilities for engineers calls for:

1 Broadened education to encompass training in fields other than the engineer's specialty.

2 Continuous replenishment and expansion of the ranks of the profession.

"The young engineer," he explained, "must be made aware of the cost factors in productivity, the labor factor, and marketability. He must be made conscious of consumers, advertisers, suppliers, and customers."

Dr. Rettaliata said the problem of broadening engineering education is receiving attention by technological colleges and universities.

Illinois Tech, he added, has been effecting changes and extensions in the curricula aimed at extending the base of engineering education to increase the graduate's potential usefulness in industry.

Citing a demand for more engineers, Dr. Rettaliata said there is "urgent" need for interesting more qualified high-school graduates in careers in engineering and science.

Pointing out that only six out of every 10 of the top-ranking five per cent of high-school graduates go to college, he said:

"There is a tremendous loss there, to engineering and other fields, of America's brightest youth."

He urged engineering societies and industry to promote and provide financial assistance through scholarships to brilliant secondary-school students so that they can pursue their education at the higher level in institutions of their choice.

Conservation of the country's resources also is a responsibility of the engineering profession, he stated.

"It is hard," he said, "for Americans, long accustomed to ideas of boundless American resources, to think of ourselves as a nation whose resources are running out.

"Yet in ever-sharper measure our attention is being called to the growing problem of shrinking stores of natural material wealth. The time has come when we must be truly scientific about the utilization of our resources."

He said engineering is entering an era of achievement that "will dwarf prior accomplishments" because of the rapidly rising population, the exploitation of new areas of scientific development, and the necessity to advance the country's technology as the foundation of national defense.

Remotely Controlled Railroad

A NEW multiple-unit railway car was successfully operated by remote control recently on the New Haven Railroad in the New Rochelle to Rye, N. Y., territory. It was pointed out that there is no scientific or technical reason why it could not have been a diesel or electric locomotive with a full complement of cars.

The remote-control panel for the demonstration was located at Larchmont, N. Y. By operating miniature levers on this way-station panel the train responded. It moved east or west, coasted or stopped, at the will of the wayside operator with no person operating the controls on the train. The movements of the train were protected by Automatic Train Control equipment so the train could not proceed unless conditions ahead were safe as determined continuously by the automatic equipment.

The control, safety, and voice-communication equipment used in the demonstration was provided by Union Switch & Signal—Division of Westinghouse Air Brake Company. This includes the Union Cab Signal equipment, electronic remote-control equipment, and Inductive Train Communication equipment.

Remote-Control Equipment

The train-carried equipment is arranged to be responsive to locomotive operation controls issued from the wayside station. A visual indicator on the train displays the control commands transmitted from the wayside station and can display "brakes off," "power on—east," or "power on—west."

The wayside equipment has a Locomotive Control Panel with two miniature-type control levers. One lever selects either "eastward" or "westward" running and the other selects between "neutral," "run," and "stop." When the lever is on neutral the train brakes are released and power is cut off. When the lever is turned to the run position, power is applied and the locomotive runs in the direction selected by the other lever. When the lever is placed in the stop position, a service application of the train brakes follows, bringing the train to a stop.

The electronic portion of the wayside equipment consists of a power supply, an audio oscillator, and a carrier modulator. The equipment creates a carrier frequency by means of an oscillator, modulates this carrier with certain audio frequencies, and amplifies this modulated carrier to the desired level of signal current. The output of the carrier modulator is connected to the existing line wires which parallel the track. The position of the two miniature-type levers on the Locomotive Control Panel determines which audio frequencies are to be introduced into the carrier modulator. When the lever is in the run position, a pair of audio frequencies is introduced into the modulator—when the lever is in the neutral position only one audio frequency is used—and when the lever is in the stop position no audio frequencies are present.

Fig. 9 Wayside equipment for remote operation of train

The control commands from the wayside station are transmitted to the locomotive through inductive coupling between the modulated carrier current flowing in

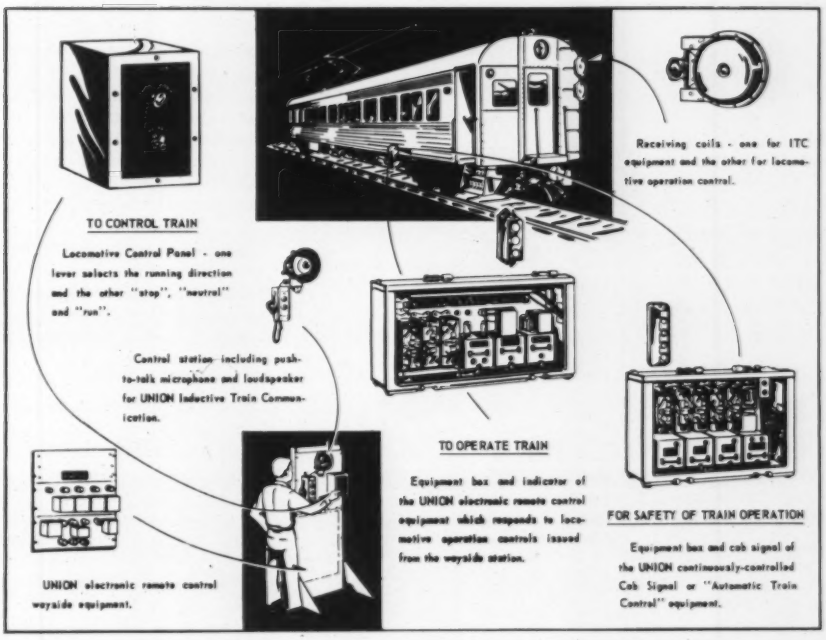

TO CONTROL TRAIN
Locomotive Control Panel - one lever selects the running direction and the other "stop", "neutral" and "run".
Control station including push-to-talk microphone and loudspeaker for UNION Inductive Train Communication.
UNION electronic remote control wayside equipment.
Receiving coils - one for ITC equipment and the other for locomotive operation control.
TO OPERATE TRAIN
Equipment box and indicator of the UNION electronic remote control equipment which responds to locomotive operation controls issued from the wayside station.
FOR SAFETY OF TRAIN OPERATION
Equipment box and cab signal of the UNION continuously-controlled Cab Signal or "Automatic Train Control" equipment.

Fig. 10 Control, safety, and communication equipment used for the remote control of the New Haven Railroad train

the line wires and a receiving coil mounted on the locomotive. The locomotive equipment is tuned to accept and act on the received signal indications from the wayside Locomotive Control Panel.

Automatic Train-Control and Cab-Signal Equipment

To conduct the demonstration with complete safety, the locomotive was equipped with a standard Union cab-signal equipment. Commonly referred to as "Automatic Train Control" this train-carried equipment is continuously responsive to rail-carried currents which reflect track conditions in advance of a train and the cab signal continuously indicates track and traffic conditions ahead. If the train should be moving and traffic conditions in advance are such that it is not safe for the train to continue, the brakes will be automatically applied and the train will be brought to a stop regardless of the controls being issued from the wayside station. This cab-signal equipment for the first time employs the use of junction-type silicon transistors in place of vacuum tubes.

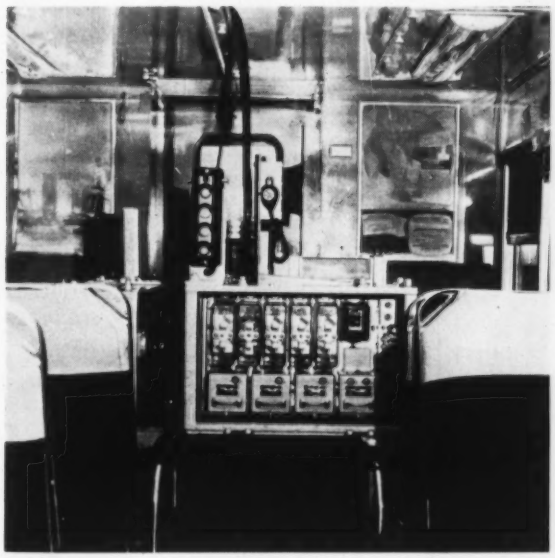


Fig. 11 Train-carried remote-control equipment which responds to locomotive operation controls issued from wayside station

Inductive Train-Communication Equipment

In order to establish two-way voice communication between the train and the wayside station a standard type of Union Inductive Train Communication equipment was installed on the train and at the wayside station. This equipment, like the remote-control equipment, operates on the inductive principle, and permits the person exercising the control from the wayside station to announce to the passengers on the train any change in the control function so that the change could be anticipated by those on the train.

Atomic-Ray Detector

A NEW wide-angle atomic-ray detector developed by General Electric Company scientists at the Hanford Atomic Products Operation is used to monitor radioactive material being removed from a flatbed truck with caustic steam.

The new device overcomes disadvantages of conventional detectors by reacting equally to atomic rays coming from various directions. On older detectors rays coming directly at the reactor registered better than

Fig. 12 Wide-angle atomic-ray detector for monitoring radioactive material

those coming at an angle, thus necessitating a safety factor in computing time workers could spend in a radioactive area.

Since the added safety factor cut down permissible working time for individuals in a given area, the new detector has expedited production at Hanford by increasing working time that individuals can remain on job, according to Dr. H. M. Parker, director of the G-E radiological sciences department.

Cleanable Micronic Filter

A NEW small, cleanable, all-metal, edge-type filter has been designed by the Cuno Engineering Corporation of Meriden, Conn., to remove micronic particles from large quantities of liquid. The new filter, Super Auto-Klean, stops all particles larger than 40 microns (other degrees of filtration are 75 microns and 0.005 in.) which is sufficient for many systems, or in those cases where finer replaceable cartridge-type elements are used as secondary filters, cartridge life is greatly extended. This is because the Super Auto-Klean prevents premature plugging of filtering surfaces in the secondary cartridge by removing all oversized particles and agglomerated contaminants.

Because of the unusually low pressure drop across the filter, flows can be handled in a space of six times smaller than would a cartridge-type unit under similar conditions. For example, a single 40-micron filter measuring only 15 in. high × 6 in. in diam will handle 30 gpm of 200 SSU oil with only a 3-psi pressure drop. With a slightly higher pressure drop 75 per cent more flow can be handled. A replaceable cartridge-type filter for the same service would measure approximately 30 in. high × 10 in. in diam and pressure drop would vary from 3 to 30 psi.

These design features of small-size, high-flow rates, and low-pressure drop are combined with cleanability. Cleaning is done without stopping flow, simply by turning the handle, by hand or motor drive. Accumulated sludge may be drained off at convenient periods through the bottom drain plug.

The effectiveness of the Super Auto-Klean has been proved by an engine destruction test recently conducted by the U. S. Army. Several identical engines were equipped with different types of filters. As they ran, dust was introduced into the air intakes and when the engine compression pressure was reduced by 50 per cent, the test was stopped. While the best life for engines equipped with cartridge-type filters was 60 hr, the engine equipped with Super Auto-Klean ran 90 hr—50 per cent longer—and compression pressure was still above half its initial value.

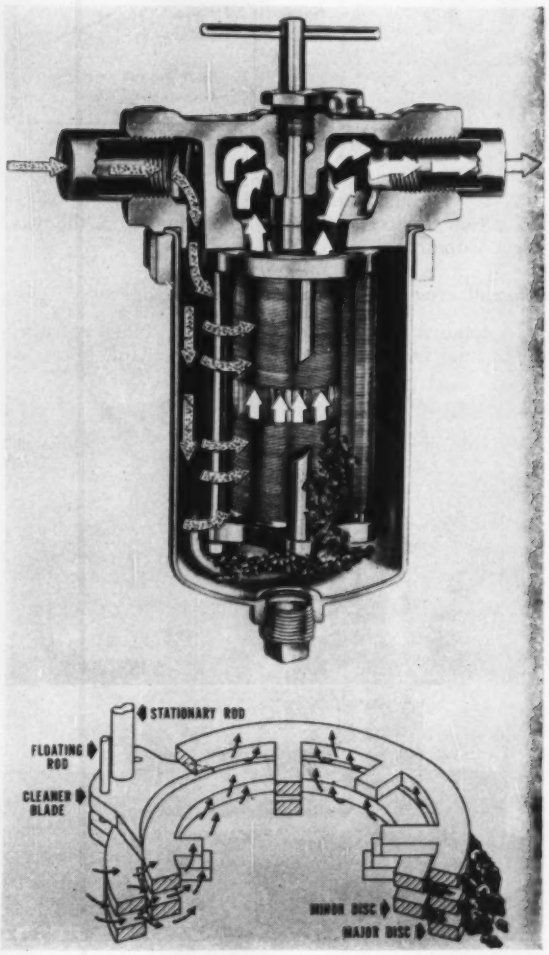


Fig. 13 *Top:* Cross section of small, cleanable, high flow rate, micronic filter. *Bottom:* Exploded view of cutaway.

Silastic Heart Valve

Because of its physiological inertness and permanent resilience, silicone rubber is a highly promising construction material for a substitute valve proposed for use in the human heart.

Developed by a group under Dr. Stanley J. Sarnoff of the National Heart Institute, Bethesda, Md., the valve is a simple ball-check unit made up of a molded Silastic case and an acrylic plastic ball. Designed to relieve aortic stenosis, a malfunctioning of the heart's main outlet valve frequently caused by rheumatic fever, the

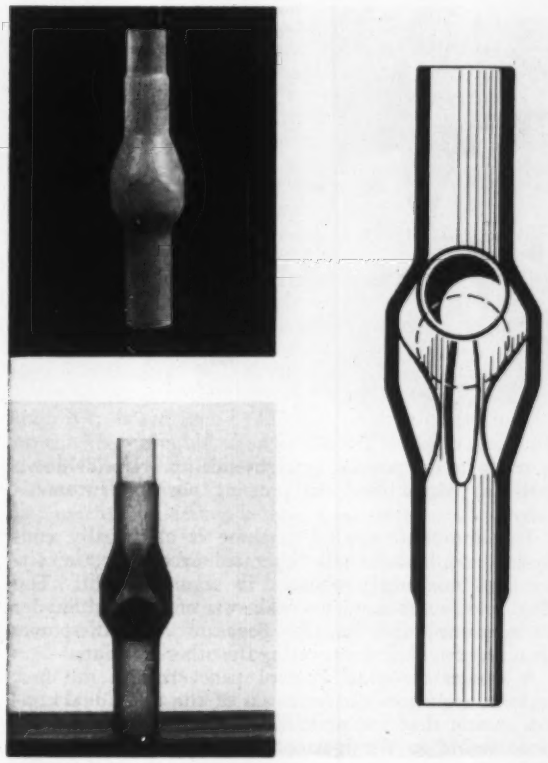


Fig. 14 Three views of the Silastic heart valve: A straight photo of the exterior; an "x-ray" type of view showing its translucence and the position of the ball-check; and a line drawing showing how it works. Still invisible is the interior finish, mirro-smooth to eliminate blood build-up or clotting. Dimensions of the valve are: 4 in. long, with a $^{5}/_{8}$-in-OD and $^{1}/_{2}$-in-ID at the bottom, $^{9}/_{16}$-in-OD and $^{1}/_{2}$-in-ID at the top, and 1-in-OD and $^{13}/_{16}$-in-ID at the widest point.

system by-passes the crippled valve by establishing a new connection from the left ventricle to the aorta.

Although Dr. Sarnoff's laboratory dog—a frisky setter—has been wearing the silicone by-pass heart valve for more than eight months, the doctor is unwilling to apply it to humans as yet until the operating procedure is letter-perfect.

In early experiments, Dr. Sarnoff attempted to use acrylic plastic for the by-pass valve. It was found, however, that when used in continuity with the heart itself the relatively hard plastic crushed the red cells between ball and chamber wall, eventually causing

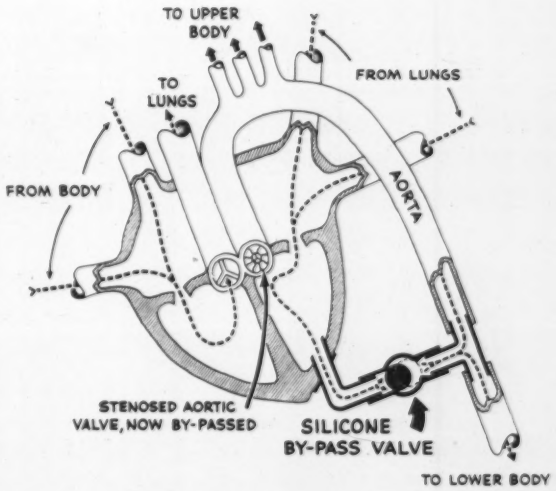


Fig. 15 The heart is a dual-stage pump, with inlet and outlet valves working in tandem for each "beat." Blood enters through separate veins from upper and lower body extremities into the right auricle, from there to the right ventricle, and out to the lungs for carbon-dioxide removal. It returns, again through separate veins, from the left and right lungs into the left auricle, and thence to the left ventricle. From here the flow is normally through the aortic valve, but when this valve narrows and tightens blood backwashes into the ventricle, forcing the heart to work harder to remove it. Sometimes the strain is just too much. The Silastic valve relieves this condition by by-passing the damaged valve entirely.

anemia. In addition, it made an annoying "tick-tock" sound with each heart beat. The resilience of the elastic silicone valve permits it to take up some of the impact when the valve closes. This has both reduced the red-cell destruction to a negligible level and has made the valve quiet.

Dozens of experimental models have already been made in Dow Corning laboratories, molded over glass or mirror-smooth alloy-steel mandrels for maximum resistance to clot formation. Flexibility of the entrance tubing allows the ball to be forced easily into place after the case is molded.

This work by Dr. Sarnoff has thus far shown no adverse physiological effects from the implant of Silastic in the body. In fact, the tissue gradually grows in place over the valve.

Segmented Transfer Machine

A segmented in-line transfer machine that machines, gages, air-tests, marks, and assembles seals in cast-iron automotive V-8 engine chain case covers at a rate of 108 pieces per hr at 80 per cent efficiency has been announced by Snyder Tool & Engineering Company, Detroit, Mich.

The machine combines the latest concepts in segmented automation, including individual bases, separate control panels for each segment, and a compact master control panel. These features cut machine-obsolescence factors, simplify maintenance and troubleshooting, and simplify transfer machine construction, tryout, and delivery problems.

The 40-station, 65-ft-long machine is made up in eight segments each having separate bases and control

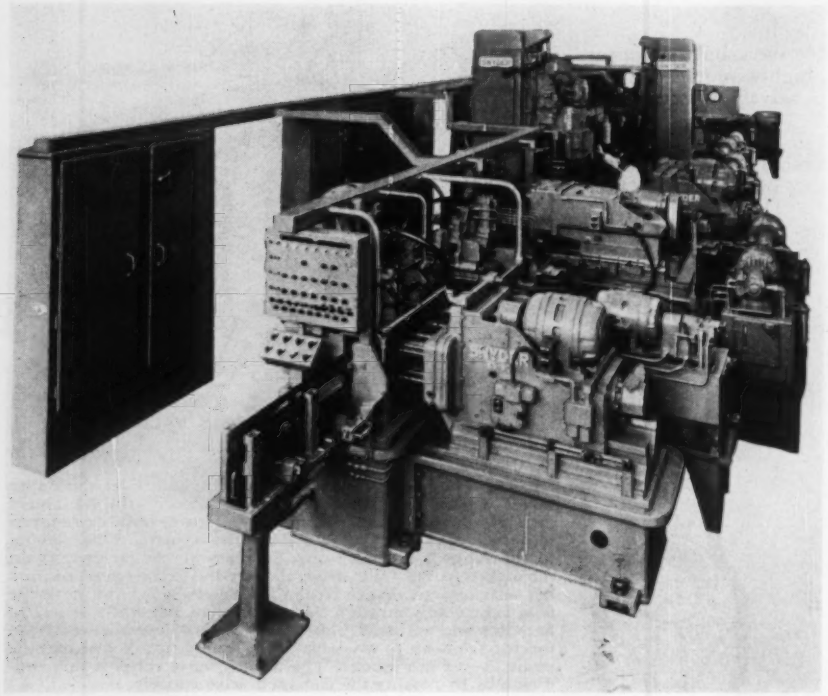


Fig. 16 Segmented transfer machine that machines, air-tests, marks, and assembles seals in cast-iron V-8 automotive-engine chain case covers at a rate of 108 pieces per hr at 80 per cent efficiency

panels. A single transfer bar carries parts from station-to-station through the machine.

A variety of drilling, countersinking, tapping, boring, and milling operations are performed in the first five segments by an assortment of standard and special vertical and horizontal slide units. Hole-inspection probes that check drilled holes to depths are provided in the third and fourth segments. If any hole is not to depth, the cycle of the next segment will not function.

In the sixth segment, the chain case cover is automatically tipped 90 deg and rotated 90 deg to orient the part in correct location for drilling, countersinking, and tapping operations in the seventh segment. After the parts leave the seventh segment, they are moved by the transfer bar through nine stations where they pass through a conventional wash, rinse, drain, and blow-off unit.

After the machine cases have been thoroughly cleansed, they are transferred to an air-test fixture in the eighth segment where they are sealed and air-tested for leaks. If a part is found to be a "leaker," it is automatically stamped with an air-operated stamping device and rejected from the transfer line at the next station.

An oil seal is pressed in at the third station in segment eight. Oil seals to be pressed into the chain cover cases are stacked in vertical-tube-hopper feed assemblies mounted on the periphery of an index table. One of the tubes lines up with a vertical chute at each index position and lets the seals in the tubes feed under a press ram. Microswitches in the vertical chute control the index of the table to the next tube position according to the condition of fill.

Suitable controls are provided at the pressing station to assure that the unit will not function unless a seal is ready to be pressed in right-side-up. Upside-down seals are ejected from the pressing position automatically.

The automatic special machine is electrically controlled and hydraulically operated except for the air-test and marking equipment in segment eight. The third and fourth segments make use of standard Snyder self-contained slide units. Separate hydraulic-power units are provided for operating the other segments.

A master electrical control panel behind the first segment sequences the functions of the individual control panels that are provided for each segment. Indicator lights in the master control panel and at each segment indicate reasons for machine shutdown.

For Authors Only

ALL publications, particularly those of technical organizations such as ASME, seem to be faced with the same problem—an overabundance of material the organization is expected to publish—much of which generally is too long, too specialized, and oftentimes repetitive. An interesting commentary by L. J. F. Brimble on this problem was printed in *Nature* (London) and was brought to our attention in the November 18, 1955, issue of *Science*. Hence, by way of *Nature* and *Science*, here are Mr. Brimble's views on what he calls "Rushing into Print:"

"There is a tendency these days among scientists to rush into print. More often now than ever before some scientists, having submitted a communication for publication, eventually ask to withdraw it or to be allowed to modify it because they either have discovered an error

or have since learned that some of the work has been done elsewhere. This tendency is also revealed in the appalling state of corrected proofs received from some authors —sometimes peppered with corrections and changes which are, at the least, very expensive to make. Rushing into print is also inspired by the bugbear of priority. For example, the request by an author that his communication should be treated as urgent because he has learned that similar work is being done elsewhere is now treated like the cry of 'Wolf! Wolf!' Requests of this sort are happening far too often. How refreshing it is when one team of workers, having heard that another is working along the same lines, gets in touch with the second group and arranges a joint communication.

"There is much complaint today concerning the amount of scientific literature that each scientist must read if he is to keep pace with his own subject. There are many reasons for this overwhelming spate, not the least of which is the overenthusiasm of scientists themselves. Too many of them imagine that just because they have written a scientific paper it is worthy of publication. The result is that the whole field of our literature extends over a wide range of scientific merit.

"Much of the detail published in a research paper is of limited interests and value. Men of science might well consider publishing only the main points of their research and filing the rest for possible reference. It was the late Lord Rutherford who once said that when writing a letter to *Nature* if you cannot say all that is really necessary in 500 words or less, then something is wrong. If every scientist throughout the world believed this and took it to heart, then I can visualize even *Nature* having no time-lag in publication at all. It is significant that, though *Nature* frequently returns a communication to an author with a request that it be reduced to two thirds or one half of its present length, I can recall only two or three instances in the whole of my more than a quarter of a century connection with *Nature* of an author replying that he could not cut his communication.

"I rather imagine it would be a good idea if every communication submitted were returned without even being read by the editor, with a covering note asking: (1) Are you sure you have said what you want to say? (2) Have you said it in the minimum number of words? (3) Is it worth saying at all? Too many scientists, especially younger ones, seem to assume that the value of a scientific paper varies directly as its length. I would strongly urge that men of science thoroughly train themselves to hold their lips tight and their pens dry until they know the facts or are sure of what they wish to say."

Nuclear-Engineering Center

PLANS for the construction of a Nuclear Engineering and Development Center, on a 530-acre site in Windsor, Conn., have been announced by Combustion Engineering, Inc., New York, N. Y.

Facilities for the complete design and development of nuclear-power reactors, for the construction of reactor cores, and for the manufacture of related atomic-fuel elements are planned. Costing upward of $5 million, the Center will begin operations late in 1956 and by 1957 will employ several hundred people in its various departments, largely engineers, scientists, and technicians. Stone & Webster Engineering Corporation has been engaged to serve as architects and engineers.

A large engineering and administrative building, a critical experiment facility for studying the physics and nuclear characteristics of reactor cores, a "hot" laboratory, and a fuel-element fabrication plant, together with related metallurgical, chemical, and physical testing laboratories, are to be erected.

Manufacturing facilities at Windsor will be of the highly specialized type required for the production of "light" components such as reactor internals, control mechanisms, and the like. These facilities will be designed to conform to all AEC safety requirements.

All "heavy" reactor work will continue to be done in the company's main manufacturing plant in Chattanooga, Tenn., where reactor components thus far produced by the company have been fabricated.

Existing facilities at Chattanooga will soon be augmented by the completion of a new bay for the manufacture of heavy reactor components. Equipment will include a 15,000,000-volt betatron for fast x raying of thick plate and welds, large precision machine tools, and cranes to handle loads in excess of 300 tons. This multimillion-dollar project will also include a dock equipped to handle reactor vessels too large and heavy for rail or highway shipment. With the completion of this project early this year, Combustion will become the first company in the world to possess facilities especially designed for the manufacture of heavy reactor components and to be able to make water shipment of such components through virtually all inland waterways and to all coastal points.

The Future of ASME

(*Continued from page 6*)

will accord the delegates a warm and enthusiastic reception and welcome. This presents an opportunity for us to promote better understanding and good will among engineers and fellow men, thus bringing us closer to the goal we all seek—a world of peace and happiness.

Closing

In closing I want to express my thanks and appreciation to each member of the Society, to each vice-president and director, to the members of my Executive Committee, and to the Headquarters Staff for the kind friendly co-operation accorded me throughout my term of office;

To the 75th Anniversary Committee, chaired by Dr. Jess H. Davis; and

To all the members serving on committees for the Annual Meeting here.

I would be remiss if I did not acknowledge, with thanks and appreciation, the wonderful reception I received during visits to Division, Section, and Student Branch meetings, by officers of those units as well as the faculty representatives at the universities and colleges.

It was also gratifying to note the presence of a number of the past-presidents of the Society at the Section Meetings I attended.

It has been a privilege to serve as your President, and I am very grateful to the membership of this Society for this wonderful and enriching experience.

On behalf of all of us, I extend to Dr. Joseph W. Barker, a distinguished engineer and our President-Elect, our best wishes and our pledge of personal support for the year 1955–1956.

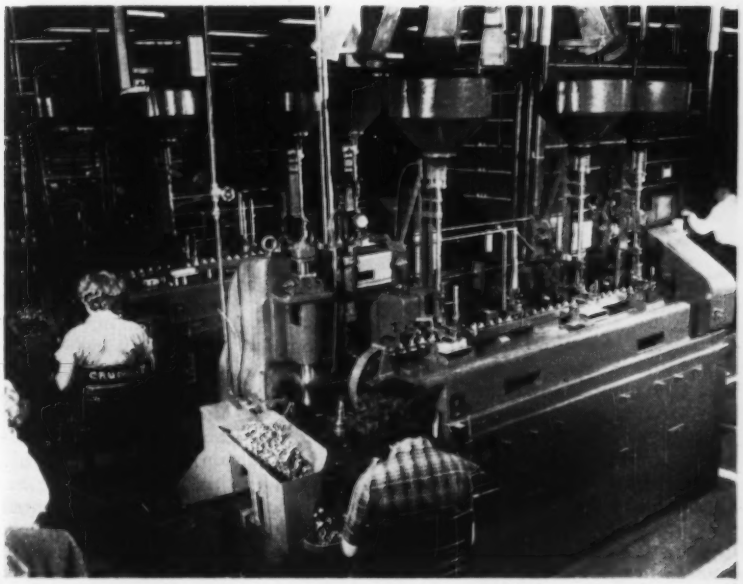
This is automation in a pretzel factory. A woman employee watches for machine error, as a battery of automatic pretzel benders moves its production onto a conveyer which carries its cargo to ovens. Many of the phases of automation shown in General Electric's new 30-min color film are being adopted by virtually all of industry. The basic manufacturing phases, according to the film, are automatic making, inspecting, assembling, testing, and packaging.

How automation increases production, raises employee skills, improves products, expands capacity, and lowers costs. . .

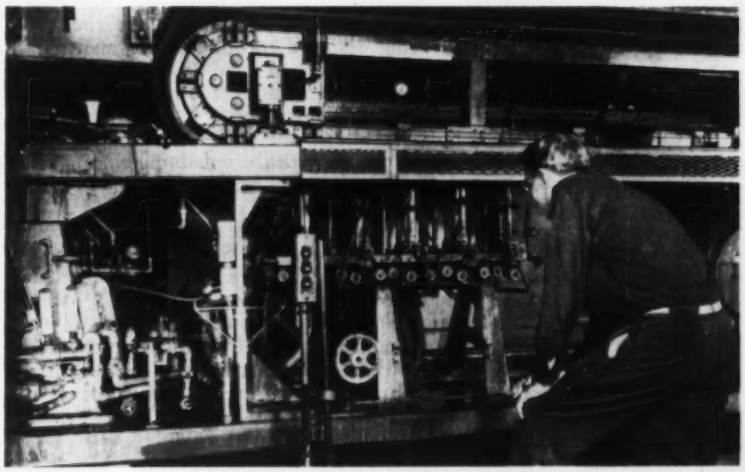
. . . shown in G-E film, "This Is Automation"

The versatility of automation is emphasized here in an application from the dairy industry. In a series of continuous automatic operations, milk containers are filled, closed, and packaged.

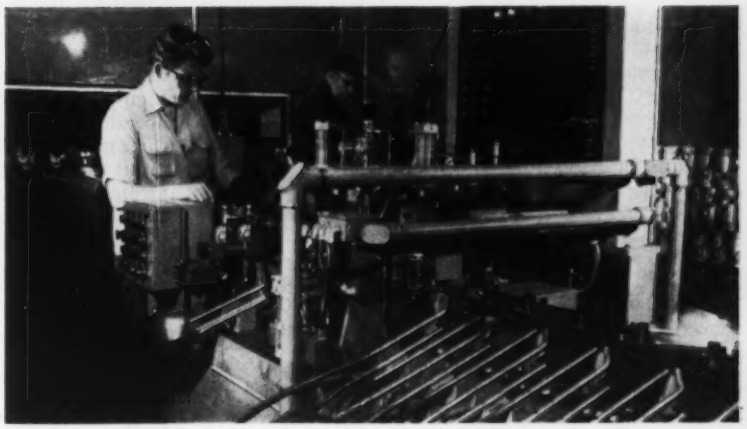
In this scene from G-E's new film, a rotary automatic punch press processes parts in an eastern manufacturing plant. This example of the "making" aspect of automation features the use of business-machine cards containing numerical data which literally direct the actions of the machine without need for drawings and conventional layouts.



Parts of condensers are fed into small merry-go-round stations by employees in this scene from the new G-E film. Following punching, the parts are automatically moved to feeder line (*upper right*) where additional forming and stamping operations take place. The color motion picture uses this and other examples to show how small and medium-sized industries can improve manufacturing operations by adopting automation.



This employee is supervising machinery equipment which automatically produces electric-light bulbs. "This Is Automation" points out that the glass industry was among the first to include continuous automatic production or automation for its manufacturing operations.



The inspection phase of automation is shown here. Automobile-engine pistons are automatically inspected after they leave the final assembly-line phase. Imperfect pistons are removed via channels (*lower right*), while the satisfactory units move by conveyer to another location where they are packaged.

European Survey

Engineering Progress in the British Isles and Western Europe

J. Foster Petree,[1] Mem. ASME, *European Correspondent*

Pametrada Research Station

From its inception, one of the main purposes of the Pametrada Research Station at Wallsend-on-Tyne, England (the name is derived from the initial letters of Parsons And Marine Engineering Turbine Research And Development Association) has been to provide facilities for testing full-size sets of turbines for ship propulsion, under conditions accurately simulating those in service, but with the advantage of the much more elaborate instrumentation possible in a shore test plant. The building is so designed that the actual boiler which will eventually go to sea with the turbines can be taken bodily into the test house through an opening in a wall.

At the present time, under a contract from Yarrow and Company, Limited, of Glasgow, Scotland, on behalf of the British Admiralty, a single-shaft set of turbine machinery is undergoing full-scale prototype development tests. The set consists of a high-pressure and a low-pressure turbine with underslung condenser, designed and built by the English Electric Company, connected to the propeller shaft by double-reduction gearing supplied by Vickers-Armstrongs Limited, Barrow-in-Furness, and taking steam from a two-drum integral-furnace water-tube boiler of the "Selectable Superheat" type, made by Babcock & Wilcox, Limited, at their works in Renfrew, Scotland. The set is equipped with all the usual turbine-driven feed pumps and various motor-driven auxiliaries.

The full power developed on the main shaft is 30,000 shp ahead and 7000 astern, the ahead speed being about 200 rpm and the astern speed about 120 rpm. The high-pressure turbine has a Curtis wheel with eight impulse stages and gives 15,000 hp at 7767 rpm. The steam conditions at the inlet to the nozzle valve chest are 695 psig at 20 per cent power and 550 psig at full power. The steam temperature is 925 F up to 60 per cent of full power and 825 F above that power loading. The low-pressure turbine is a six-stage double-flow impulse unit, with a Curtis wheel at each end for astern running; it develops 15,000 hp ahead at 6023 rpm and 7000 hp astern at 3707 rpm. The single-pass regenerative condenser is arranged athwartship and will maintain a vacuum of $26^1/_2$ in. Hg at full power when supplied with 27,000 gpm of circulating water at 55 F. The maximum velocity in the tubes is specified not to exceed 10 fps. The gearing from the high-pressure turbine to the propeller shaft has a reduction ratio of approximately 40:1, and that of the low-pressure turbine, approximately 30:1.

The boiler has a drum working pressure of 700 psig and a maximum steam temperature at the superheater outlet of 950 F.

[1] Correspondence with Mr. Petree shoud be addressed to 36 Mayfield Road, Sutton, Surrey, England.

The nine oil sprayers, arranged in two groups of four, with one spare, are of the spill-controlled type developed by Joseph Lucas & Company, Birmingham, England, and have a "turn-down ratio" (that is, the ratio of maximum output to minimum output) of not less than 10:1. The standard nozzles used will each pass 3750 lb per hr of oil of a viscosity of 60 S.R.I., with a pressure at the manifold of 850 psi. The main and auxiliary feed pumps, made by G. & J. Weir, Limited, Glasgow, are four-stage centrifugal units, driven through gearing by vertical-spindle steam turbines. The pumps run at 4375 rpm for the specified duty of supplying 384,000 lb of feed water per hr at 840 psig, the conditions at the pump inlet being 240 F and 32 psig.

The other auxiliaries, for the turbines and the boiler, represent the most up-to-date marine practice, the whole installation being designed to obtain performance data from the various components and systems in order to assess their suitability for future adoption in warships. For test purposes, the installation is accommodated in two adjoining buildings, the boiler with its auxiliaries in one and the turbines with the remaining auxiliaries in the other. The turbines and gearbox are mounted with their shafts horizontal, instead of being inclined as they would be in a ship, but otherwise shipboard practice has been followed. Moreover, the whole plant can be operated by remote control from a special room, erected in the test house, corresponding to the "A.B.C." (Atomic, Bacteriological and Chemical warfare) control room on board ship. The power output from the main turbines is absorbed in a hydraulic dynamometer capable of absorbing 60,000 hp at 300 rpm and of switching rapidly from ahead and astern.

8400-Shp Double-Casing High-Pressure Set

While the marine-turbine installation is the most impressive unit under test by Pametrada at the present time, there are other developments on hand of no less technical interest. One of these is the double-casing high-pressure set, of 8400 shp, shown in Fig. 1, which operates with steam at 575 psig and 940 F. It comprises three main parts, namely, a fabricated outer casing which forms the main strength girder for the ahead and astern turbines, a cast inner barrel containing the ahead nozzles and blading, and an astern cylinder. As will be seen, the astern rotor is on the end of the spindle and is overhung. The inner barrel exhausts into the outer casing, which is subjected, therefore, only to the exhaust steam pressure and temperature and is relatively cool (about 400 F). The design is suitable for inlet temperatures as high as 1200 F. The barrel is of simple design, which enables it to better withstand temperature changes when maneuvering and also simplifies machining. It is sup-

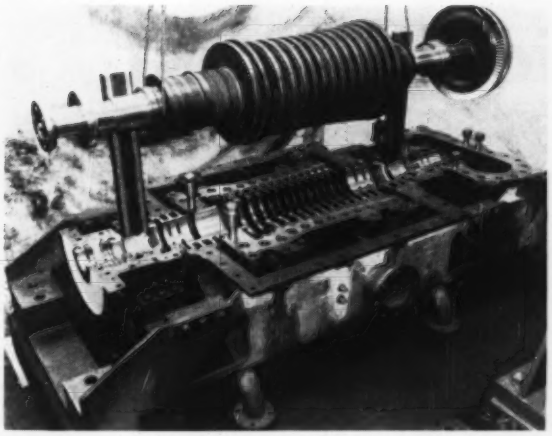


Fig. 1 Double-casing high-pressure turbine of 8400 shp, with overhung astern turbine at Pametrada Research Station

ported on brackets on the inner surfaces of the side walls, on which it rests on palm extensions of the horizontal joint flange. It is located axially by keys at the inlet end. The inlet-end palms are free to slide outwardly and the exhaust-end palms can slide both outwardly and axially. This method of support appreciably reduces hogging of the barrel. Athwartship alinement is insured by keys or chocks on the vertical center line at each end of the bottom half of the barrel.

The outer casing is extended forward and aft to the turbine feet, and, as the illustration shows, the side and bottom plates of the extensions have triangular openings cut in them, to restrict the flow of heat from the exhaust casing and to permit differential expansion without destroying the rigidity of the framework. The bearing pedestals are carried on cross beams slung from springing plates on the side walls, at the level of the center line.

Athwartship location of the beams is provided by vertical keys on the turbine center line, at the end walls of the exhaust casing. The general flexibility of the design is maintained by giving radial freedom to all steam connections to the inner cylinder where they pass through the outer casing, either by the use of diaphragms or by sleeves with piston rings. The fact that the astern turbine is overhung allows free radial expansion while maintaining true alinement and axial location. A feature of the design is that it lends itself to progressing, during manufacture, in a number of subassemblies on which work can proceed simultaneously, with considerable saving in production cost; and the relatively low temperature of the exhaust casing reduces appreciably the weight and cost of lagging.

Self-Contained Boiler Unit

Developments in the production of compact steam generators are also carried out at Pametrada Research Station; more than one self-contained boiler installation suitable for general industrial use was exhibited at the 1955 Engineering and Marine Exhibition in London. By courtesy of the makers, John Thompson Water Tube Boilers, Limited, Wolverhampton, England, some test figures can now be given for one of these units, the "Minipac" boiler, which is shown in Fig. 2.

This type of boiler is being standardized in four sizes with evaporations of 3500, 5000, 7500, and 10,000 lb per hr, respectively, and for working pressures up to 250 psi, according to requirements. It is of the two-pass shell type, completely enclosed in an insulated casing, the over-all dimensions for the four sizes, over the casing, being 5 ft wide, 6 ft 6 in. long, and 5 ft 6 in. high; 7 ft wide, 7 ft 8 in. long, and 5 ft $10^3/_4$ in. high; 9 ft 3 in. wide, 10 ft 3 in. long, and 7 ft 6 in. high; 10 ft 3 in. wide, 10 ft 9 in. long, and 8 ft 6 in. long. In each size, the boiler is complete with forced-draft fan, fuel, and feed pumps, etc., and, as all boilers are fully steam-tested at the works, requires only to be coupled up to the water supply, steam outlet, chimney duct, and the electricity supply for the auxiliaries.

The fittings include two sets of water gages, steam gage, two safety valves, main stop valve, and an injector. Test points are provided for recording temperatures and draft pressure. Integral electrical and mechanical automatic control panels are built into one side of the casing.

In the 3-hr test for which particulars have been supplied, the fuel was Esso diesel-fuel oil with a specific gravity of 0.8259 at 72 F and having an analysis of 86.3 per cent carbon and 12.62 per cent hydrogen. The calorific values were 19,620 gross and 18,420 net Btu per lb. The corrected oil flow was 37.70 Imperial gal per hr. The steam pressure was 94.2 psig; the fuel pressure, 169.2 psig in the left-hand combustor and 163.7 psig in the right-hand combustor; the burner air pressures, left hand and right hand, 11.7 and 12.1 in. w.g., respectively; and the combustion chamber pressure, 8.6 in. w.g.

The suction at the stack base was 0.24 in. w.g. and the forced-draft fan pressure, 18.8 in. w.g. The ambient air temperature was 55.4 F. The flue-gas exit temperature was 574.3 F and the gas analysis showed 11.95 per cent CO_2, 4.4 per cent O_2, and CO nil. The steam flow was 4153 lb per hr and the equivalent evaporation, from and at 212 F, was 4990 lb per hr. The overall efficiency on the gross calorific value was 79.3 per cent. The radiation loss was notably low for a unit of this type, being only about $1^1/_2$ per cent.

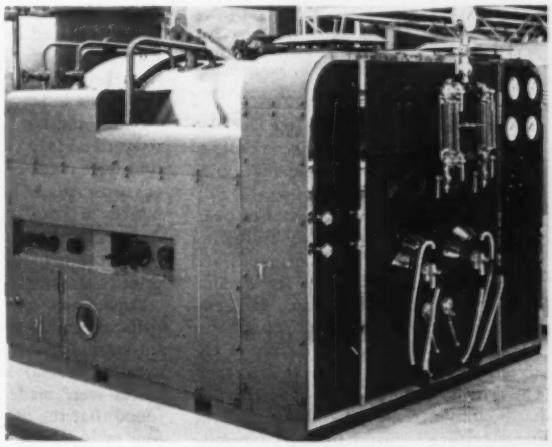
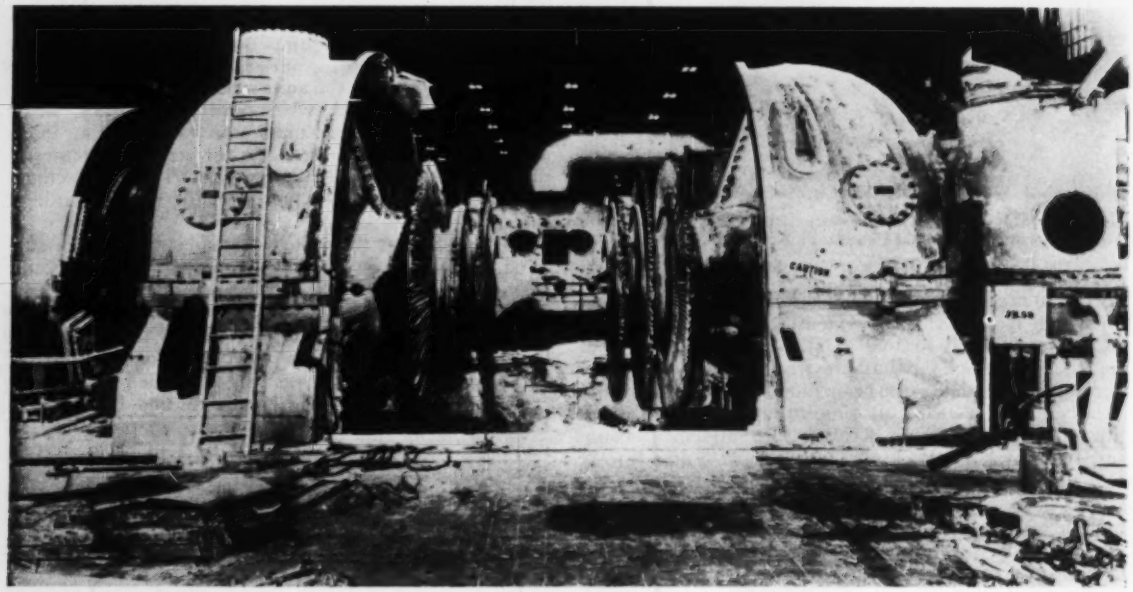


Fig. 2 "Minipac" self-contained steam generator made by John Thompson Water Tube Boilers, Ltd., Wolverhampton, England

ASME Technical Digest

Substance in Brief of Papers Presented at ASME Meetings



Close-up of low-pressure turbine shortly after accident at Ridgeland Station of Commonwealth Edison Company at Chicago

Turbine-Materials Failure

Investigation of Large Steam-Turbine Spindle Failure, by H. D. Emmert, Mem. ASME, Allis-Chalmers Manufacturing Company, Milwaukee, Wis. 1955 ASME Diamond Jubilee Annual Meeting paper No. 55—A-172 (multilithographed; to be published in Trans. ASME); available to Oct. 1, 1956.

SHORTLY before midnight on Dec. 19, 1954, the low-pressure turbine spindle of Unit No. 4 in the Ridgeland Station at Chicago, Ill., of the Commonwealth Edison Company burst during a routine overspeed-trip test. Immediately following this tragic occurrence, a continuous and intensive investigation of its circumstances and cause was initiated and completed within four months. This paper was prepared to present the story of the investigation and analysis of the accident. The primary purpose of the investigation has been to increase the knowledge of the steam-turbine industry so as to minimize the possibility of similar occurrences in the future.

Ridgeland No. 4 is of conventional cross-compound design, with the high-pressure turbine turning at 3600 rpm and the intermediate-pressure and low-pressure turbines in tandem on the 1800-rpm shaft. The unit is rated at 150/165 mw and was placed in commercial service on Aug. 19, 1954. The 1800-rpm low-pressure turbine is of double-flow construction.

Ridgeland No. 4 was first brought up to speed on July 17, 1954. Five overspeed runs were made on that date during various operational checks. The unit was placed in regular scheduled service on August 19, and there were a total of ten start-ups, including nine overspeed tests, prior to the start-up of December 19.

Although it was not possible to remove parts and fragments of the turbine from the station for some weeks following the accident, visual surveys of the spindle pieces were made immediately. It was found that the main body had burst into four main pieces.

A probable sequence of failure can be established with considerable accuracy from the examinations of fragments. While the failure was explosive in nature and occurred completely in a fraction of a second, the sequence of events is believed to be as follows:

1 Initial failure originated at the bore within the main body and progressed in a longitudinal plane both radially and toward the shaft ends, tending to split the main body into two halves. The actual pin point of origin cannot be determined positively, but a probable location has been identified as a granular area on one of the major cleavage surfaces adjacent to the bore.

2 Extension of the primary failure into the shaft ends was limited by the clamping effect of the shrunk-on rings. These rings also restrained the two halves of the main body, and extremely high stresses were then set up at the fillet corners. Secondary failures from these corners immediately progressed in an inward direction toward the center of the main body.

3 As cracks from the fillet corners progressed in a direction to free the halves of the main body, strong centrifugal forces

in each of these halves almost simultaneously split them into quarters. At the same time the center portion of the material enclosing the bore in the main body fragmented, leaving conical segments attached to each of the spindle extensions. These segments, already split in two by the original primary failure, also quartered with the larger pieces.

4 The quarter sections of each of the cones, eccentric and overhung and possibly not yet completely free of the main central pieces, tended to break off at the points of restrain under the rings. At some locations these segments broke free; at others, portions remained attached to the shaft extensions.

While the sequence of failure was originally deduced solely from examination of the fragmentation of the Ridgeland shaft, it has since been confirmed with considerable accuracy by bursting tests of $^1/_{15}$-size cast-iron models.

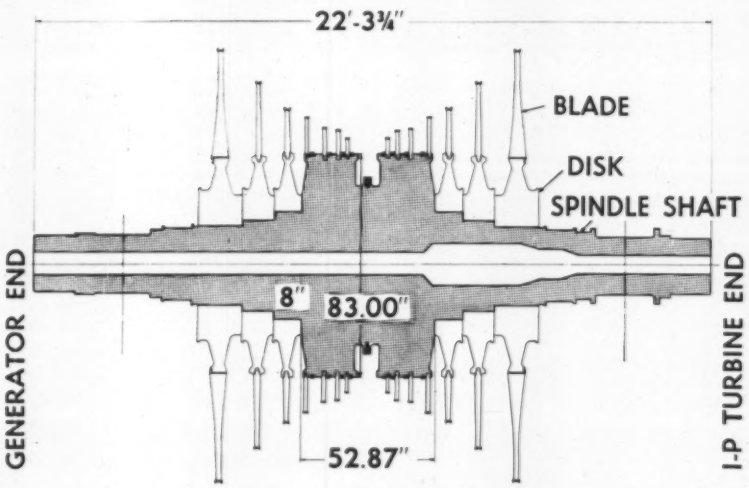
A study of the sequence of failure has indicated that it originated deep in the mass of the main body of the shaft. Metallurgical examinations have confirmed the fact that the metal was notch-sensitive and susceptible to brittle failure. Various inspection techniques have shown the presence of an overabundance of cracks in the form of flakes, providing the notches necessary to trigger a sudden and catastrophic failure of the shaft. The only point of uncertainty is the means by which the shaft maintained its integrity as long as it did. It is probable that failure started when one or more of the numerous flakes in the main body near the bore extended slowly and approached the bore surface, a region of high local stress. At this instant the brittle nature of the material caused this surface crack to widen into a major separation at an extremely high rate of propagation.

It is evident from this investigation that the Ridgeland low-pressure turbine failure is primarily centered around the metallurgy of large forgings. This and other incidents have served to focus much attention on material specifications and on the general procedures for producing and inspecting these large pieces of metal.

Much development work within the forging industry will be required so that techniques and controls are established to eliminate all possibility of flakes in large forgings. The allowable hydrogen content in an ingot is probably well under 2 ppm, and ladle metal generally runs 4 ppm or higher. Even partial control of hydrogen requires controlled heats and close attention to tapping and pouring procedures. Hydrogen-free steel could be produced if the steelmaking process was isolated from all sources of hydrogen, but this is very difficult to accomplish in manufacturing large ingots. Most attempts at hydrogen control have been in the direction of removing the gas after it has already been introduced. One of the most promising current developments is the vacuum-casting process, which has received considerable attention in Europe.

An equally important factor in large-forging development is the improvement of inspection methods. The Ridgeland forging was produced about four years ago and, in the intervening period, much has been accomplished in this respect. As a matter of policy, all large turbine shafts are bored axially since optical and magnetic-particle inspection of the bore surface gives a good indication of the general quality of the forging. However, some of the more dangerous types of discontinuities may lie away from the bore and hence not be detectable by bore inspection. Ultrasonic inspection has become most important for the interior examination of metal masses, and intensive effort has been put into the development of improved sonic-inspection techniques. Forgings are now searched both radially and longitudinally at various frequencies, and techniques for searching radially outward from the bore are under development. Shear-wave crystals have been brought into use to improve the examination of areas formerly difficult to reach with straight crystals.

Even more important than the development of new sonic-inspection techniques is our continually increasing knowledge enabling better interpretation of test results. The most common sonic indication is that of inclusions and segregations of inclusions found in nearly all large forgings. It is frequently difficult to distinguish between these harmless types of discontinuities and the more dangerous types of flaws such as flakes or thermal cracks. It is now considered that the determination of pattern and distribution of indications are as important as the measurement of the magnitude of any particular individual indication, and it is in this respect that a growing background of experience and information in interpretation is greatly improving the inspection situation.



General construction and principal dimensions of the low-pressure turbine spindle

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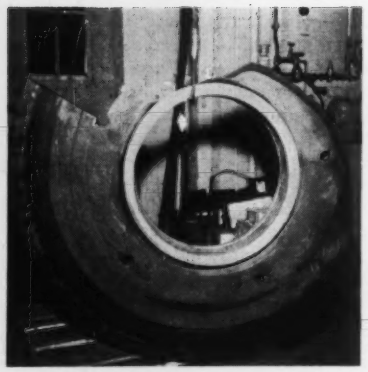
Report of the Investigation of the Turbine-Wheel Fracture at Tanners Creek, by A. W. Rankin, Mem. ASME, and B. R. Seguin, General Electric Company, Schenectady, N. Y. 1955 ASME Diamond Jubilee Annual Meeting paper No. 55—A-210 (multilithographed; available to Oct. 1, 1956; to be published in Trans. ASME).

This paper sets forth the results of an investigation into the causes of the turbine-wheel fracture which took place early in January, 1953, on the 1800-rpm low-pressure element of Unit No. 1 at the Tanners Creek Station on the American Gas and Electric system. The front standard, which contains the No. 1 bearing, the thrust bearing, hydraulic cylinder, and governing mechanism—cracked, and the resulting oil leakage caused a fire within the station. When the turbine was opened for inspection, it was found that a segment of approximately 160 deg had broken out of the first-stage (reheat) wheel of the intermediate-pressure turbine section.

A review of the results of all the investigations conducted on this turbine rotor indicates that the most probable cause of this fracture was a combination of residual stresses which were not re-

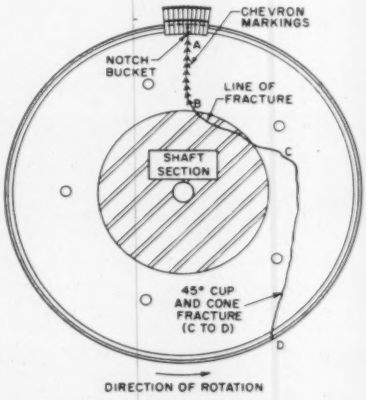


Photograph of Tanners Creek broken wheel after machining from shaft

moved by the tempering and stress-relief heat-treatments, an unusually low long-time, high-temperature ductility, and thermal stressing of the first-stage wheel due to admission into the first-stage wheel space of wet steam from the steam-seal regulator piping. Improved practices have been introduced to avoid the recurrence of difficulties due to any of these contributing causes: Specifically, residual stresses are now measured on all rotor forgings prior to machining; a modified heat-treatment has been introduced to give better long-time high-temperature ductility, although at some sacrifice in high-temperature strength; and the piping of steam-seal regulators has been modified to minimize the possibility of wet steam thermally stressing the rotor wheels.

The fracture originated at the two holes in the wheel rim through which the notch bucket is attached to the wheel and an improved notch assembly has been developed in which such pinning is not required. The developments and investigations aimed at producing a turbine-rotor steel with greatly improved high-temperature long-time ductility are by no means limited to the change in heat-treating temperatures; the effects of significant changes in alloy composition together with liquid quenching from the austenitizing temperature are also being investigated on full-size turbine rotors. In addition, the effects of vacuum pouring of the rotor ingot are also being investigated on a full-size turbine rotor to determine if this practice, in addition to the improvements in room-temperature properties expected from this innovation, will also produce an improved high-temperature ductility.

In the several months immediately following the Tanners Creek fracture, all duplicate units were thoroughly inspected; in particular, the notch buckets were removed from the first-stage wheels and a direct inspection made of the wheel rims in the vicinity of the notch opening. No signs of any incipient troubles whatsoever were found in these inspections. It should be noted that the No. 1 unit at the Philip Sporn Station of the American Gas and Electric Company system, which unit is identical to the Tanners Creek No. 1 unit, had experienced an overspeed of between 40 per cent and 50 per cent several months prior to the subject fracture, and later inspection of this unit showed no signs of trouble except for the loss of some bucket covers in one of the latter stages and rubbing of the root spill strips on the first-stage (reheat) buckets.



Sketch of Tanners Creek first-stage wheel showing line of fracture

The presence of residual stresses seems to be one of the major contributing causes of this wheel fracture and, as previously stated, has resulted in the policy of measuring such stresses on all rotor forgings prior to machining. The results of such measurements on a number of roots produced since the Tanners Creek fracture indicate that the residual stresses in the latter were unusually high and in particular are not representative of the results normally obtained with this alloy or its manufacturing practice

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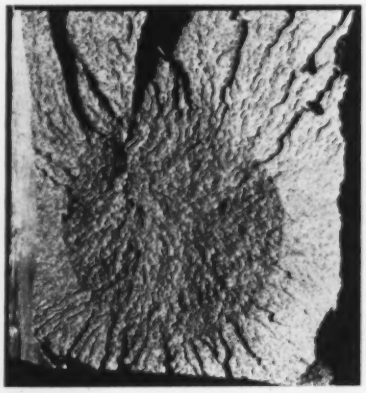
Report of the Investigation of Two Generator-Rotor Fractures, by C. Schabtach, Mem. ASME, E. L. Fogleman, A. W. Rankin, Mem. ASME, and D. H. Winne, General Electric Company, Schenectady, N. Y. 1955 ASME Diamond Jubilee Annual Meeting paper No. **55—A-208** (multilithographed; available to Oct. 1, 1956; to be published in Trans. ASME).

On March 4, 1954, the rotor of a 147,000-kva, 3600-rpm generator being manufactured for the Arizona Public Service Company burst while being balanced in the factory. The balancing was being done in the "precision balance pit," a below-floor-level trench in which the rotor was driven by a small steam turbine. It had been run intermittently at speeds below 2000 rpm as part of the normal balancing procedure and was being brought slowly up to full speed when it burst suddenly at about 3400 rpm.

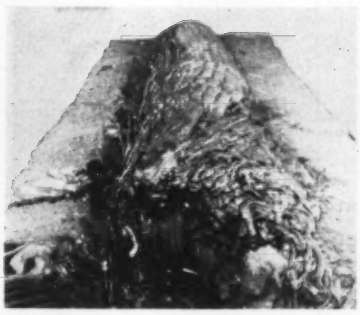
The body dimensions of this rotor were 39 in. in diam × 15 ft long. Several dozen others of the same or larger size are in service. The Arizona rotor, however, was unique in two major respects: First, the number of large indications observed during ultrasonic testing of the rotor forging was greater than in any other forging accepted since sonic testing of rotors was begun in 1947. Second, a series of plugs had been shrunk into the bore of the rotor to increase its magnetic capacity.

After the rotor burst, it was evident from the large number of fragments and examination of the fracture surfaces that the burst occurred in a brittle manner. No single origin of fracture could be found. However, there were numerous flat circular areas of about $1^1/_4$ in. in diam on the primary fracture surfaces, noticeably different in color and texture from their surroundings.

On Sept. 27, 1954, the rotor of the 216,000-kva generator at the Cromby Station of the Philadelphia Electric Company burst while running at 3780 rpm to check the overspeed trip preparatory to putting the machine on the line following a week-end shutdown. The unit had been put in service about three months earlier and had previously satisfactorily undergone two overspeed trip tests to 3950 rpm. It had been



Distinctive circular mark on primary fracture surface of Arizona rotor



View of broken Cromby rotor after removal of upper half of stator frame and core

started and stopped twenty-one times.

Except for an oil and hydrogen fire which was quickly extinguished and minor damage to the turbine due to vibration plus a sudden forward movement of the rotor, the damage was contained within the casing of the generator. Preliminary observation of the generator following the accident showed that the generator field had burst in about the same manner as the Arizona rotor. Subsequent examination of the broken pieces showed that the main fracture in the rotor passed through a row of holes drilled and tapped into the rotor body to hold studs used to repair damage caused by the breaking of a milling cutter during machining of the coil slots.

The forging which was used for the Cromby rotor is one of the largest employed for 3600-rpm machines. As received from the vendor the forging weighed about 118,000 lb and was 36 ft long with a main body 43 in. in diam and 20 ft long. Forgings of the same size have been employed in 36 other generators put in service since 1953. All of these have operated satisfactorily.

This forging was produced from an 82-in. octagonal ingot weighing 269,000 lb. An acid open-hearth heat filled the body of the ingot plus 3 in. of the sinkhead, and a basic electric-furnace heat was used to fill the hot top.

It was concluded that the Arizona and Cromby rotor bursts were caused primarily by unusual and severe stress concentrations combined with the characteristics of the materials from which these rotors were made. In the Arizona rotor, these stress concentrations were created by numerous internal cracks in the body of the forging. Although the best methods of nondestructible examination known at the time were used to determine the soundness of the forging, ultrasonic indications in the body were interpreted as caused by harmless dirt and slag similar to that found in the bore. In the Cromby rotor, these stress concentrations were created by a row of holes drilled and tapped in the rotor body for the attachment of studs used to repair portions of the teeth damaged when milling the coil slots.

Alloy segregation, in stringlike regions of above-average alloy content, contributed to the cause of both bursts. The strength and ductility of the metal in these segregations have been found to be low. In the Arizona rotor, the segregations appear to have been the nuclei of the internal cracks formed during manufacture of the forging. In the Cromby rotor, the corner of the stud hole at which the primary fracture originated was in one of these segregation regions. This coincidence seems to explain the bursting of this particular rotor when spin tests of models and the successful operation of other identical rotors indicate that it should not have burst.

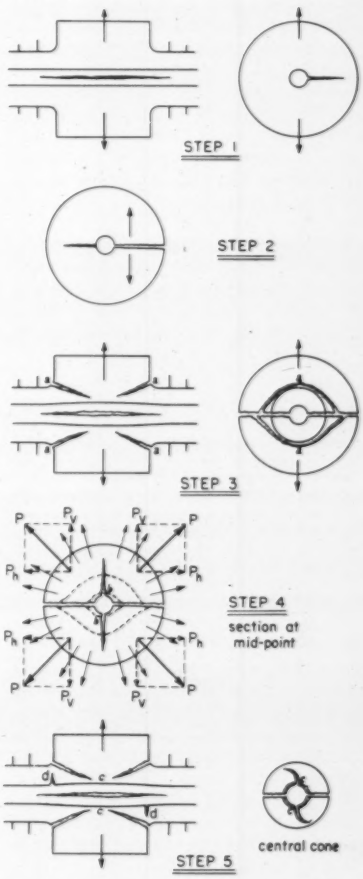
The hydrogen content of both rotors caused the ductility of the material, as measured in tensile tests, to be lowered significantly. However, the hydrogen is believed not to have been the cause of the brittle nature and rapid propagation of the fracture throughout the rotors. It may have contributed to the starting of a small crack at the corner of the stud hole in the Cromby rotor, but no evidence of such a small crack, different in character from the rest of the primary fracture, could be found. In the Arizona rotor, the hydrogen may have contributed to the formation of the internal cracks during manufacture of the forging, although the amount of hydrogen present was at the lower end of the range normally associated with hydrogen flaking.

This investigation has led to a better understanding of the relationship between the behavior of steel in massive rotors and its behavior in laboratory tests and of the relationship between its behavior in different kinds of tests, which afford guidance for mechanical design within the limitations of available materials and for the development of better materials.

Large Rotor Forgings for Turbines and Generators, by R. E. Peterson, Fellow ASME, N. L. Mochel, Mem. ASME, J. D. Conrad, Mem. ASME, and D. W. Gunther, Westinghouse Electric Corporation, East Pittsburgh, Pa. 1955 ASME Diamond Jubilee Annual Meeting paper No. **55—A-215** (multilithographed; available to Oct. 1, 1956; to be published in Trans. ASME).

THE materials used for turbine and generator forgings together with precautions taken with respect to soundness and high quality are described. Although important progress has been made in recent years, it is recommended that the following directions be pursued: (1) Continue advances in ultrasonic detection and evaluation; (2) strive for lower transition temperature in rotor materials as an added margin of safety; (3) consider starting procedure which assures a bore temperature near that of normal operating con ' ions when the rotor is brought to speed. This would provide an added margin of safety and might involve a longer starting period for a turbine after a prolonged shutdown, or preheating of a generator rotor. It is believed, therefore, that based on all available evidence, a sound, ductile rotor, free of severe stress concentrations, possesses a large margin of safety.

Some tests of cast-iron and steel model



Proposed theory of failure sequence of bored rotor with enlarged central portion

rotors are described. Tests of model cast-iron rotors gave results in agreement with a theory regarding a mode and sequence of failure at Ridgeland. The steel model did not fail until the mean stress reached the tensile strength. It should be noted that the mean stress in a typical turbine-generator is only about one third of the tensile strength at 20 per cent overspeed. Differences, other than defects, which can occur in large rotors as compared to model rotors, and which might conceivably affect the strength have been studied and should continue to receive careful consideration.

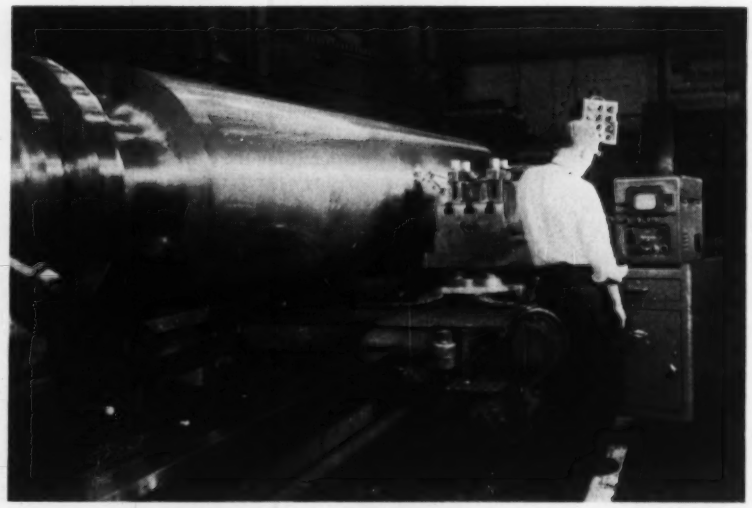
An instance was cited wherein a 100,000-kw turbine-generator was accidentally overspeeded 50 per cent without failure; at this overspeed the mean stress was about one half of the tensile strength.

The fatigue problem is discussed and the role of careful alignment emphasized. Since starting and stopping may be regarded as cycling, this is discussed as a fatigue problem and the indications based on calculations were that only a very severe defect, unfavorably oriented, would be expected to behave as a source of a fatigue crack. Such defects are quite rare and readily detected by modern methods: Under no circumstance, as previously indicated, would defects of this type be acceptable.

All aspects of turbine and generator rotors—material, inspection methods, design—are being continuously reviewed to assure that reliable rotors will be produced to satisfy the growing requirements of the electric-power industry.

Acceptance Guides for Ultrasonic Inspection of Large Rotor Forgings, by A. W. Rankin, Mem. ASME, and C. D. Moriarty, Mem. ASME, General Electric Company, Schenectady, N. Y. 1955 ASME Diamond Jubilee Annual Meeting paper No. **55—A-194** (multilithographed; available to Oct. 1, 1956; to be published in Trans. ASME).

THIS paper discusses interpretation techniques, nomenclature for ultrasonic inspection, formation, and calibration of inspection guides, and reviews records of 1500 rotor forgings. The acceptance guides are based on design and manufacturing experience with turbine and generator rotor forgings in the weight range of approximately 20,000 to 150,000 lb. These guides recognize fundamentally the extreme difficulty of producing forgings in this weight range completely clear of ultrasonic reflections, and they furnish reasonable and conservative assurance against the acceptance of forgings containing injurious defects.



Ultrasonic inspection of generator rotor forging at General Electric Company. Crystals are held in toolholder of lathe and moved along forging at about 1 in. per revolution while forging is rotated continuously at 3 to 4 rpm.

They furnish an outer line below which cracked forgings have not been encountered, an inner line which is well within the outer line, and a trepanning policy for the evaluation of forgings whose number/magnitude lines are outside either the inner or outer lines. Accordingly, these acceptance guides furnish a means of guarding against the acceptance of forgings with injurious defects without causing the unwarranted rejection of forgings with harmless nonmetallic inclusions.

It should be noted that these acceptance guides are suggested only for application to the specific weight range in which they have been evaluated, and in this range no attempt is made to distinguish between individual weights and diameters. Specifically, these guides are used directly for either a 20,000 or a 150,000-lb forging. Although the defect-reflection magnitude has no direct relation to the forging weight or diameter, being based solely on the bore reflection, there is some evidence that the number of defects increases with both forging weight and diameter. Therefore it is possible that using the number of indications as a criterion penalizes the larger forgings, and it might be more logical to use instead the number of indications per unit volume. Since other qualifications of equal validity can also be considered as, for instance, the axial and radial distribution of defects within a given unit volume or even the operating stress levels, it appears more conservative to consider primarily the defect magnitude and number of defects alone. In particular, it should be noted that the penalty of this simplification is only that further evaluation, in the form of trepanning, may be more frequent than necessary on the larger forgings, but in view of the recognized difficulty of producing the larger forgings to the high-quality standards desired by both the vendor and user, the possible additional trepanning to insure freedom from injurious defects is not warranted.

It is fully appreciated that the available data for establishing these acceptance guides are rather limited, although the authors believe that these are the best and most extended data available. Further trepanning will be done in the future on an almost continuous basis, and the positions of the inner and outer lines will be revised whenever the results of the trepanning indicate that such revision is necessary. The authors' company believes, however, that this publication of current acceptance guides together with the limitations of the data on which such guides have been based is to the best interests of the power-generation industry. In the future it is planned to publish in a similar fashion any modifications of the inner and outer lines if trepanning should show that such modification is necessary.

The Work of the Task Group on Brittle Failure of Large Steel Forgings, by Adolph O. Schaefer, The Midvale Company, Philadelphia, Pa. 1955 ASME Diamond Jubilee Annual Meeting paper No. **55—A-209** (multilithographed; available to Oct. 1, 1956).

THIS paper was presented on behalf of ASTM Sub-Committee VI of Committee

A-1 on steel products. This task force comprises representatives of eight companies—three manufacturers of electrical equipment, five manufacturers of large forgings for turbines and generators. This represents all of the makers and users of large forgings of this type in the United States. The task force has met monthly since it was formed. Partial meetings were held in Europe during the recent World Metals Congress.

It began its work by reviewing the failures discussed at this meeting. These were described in detail, and the comments of the task force guided the testing programs so that test data were obtained which could be correlated to the greatest extent.

It has sought to rationalize the rather broad charter under which it came into existence. The work it has had to do subdivides itself naturally into three main headings.

1 To discover a test to determine whether or not a steel is subject to brittle failure, or its relative susceptibility to brittle failure.

2 To attempt to make rotors less susceptible to brittle failure.

A By heat-treatment.
B By chemistry.
C By vacuum pouring techniques.

3 To develop methods of inspection and of interpretation to avoid brittle failure of forgings in service.

It is important to realize that the manufacture of turbine and generator rotor forgings has, throughout the years, been subject to constant review, and has been changed and improved with the growth of metallurgical and engineering knowledge and experience. It is safe to say that this product has commanded the attention of our best talent, and represents the finest practice that the industry knows of. The excellent record of our units substantiates this. The new factor, introduced by the task group, is the correlation of thinking and experience to the end that our development may be more rapid.

Applied Mechanics

Comparison of Slip-Line Solutions With Experiment, by E. G. Thomsen, University of California, Berkeley, Calif. 1955 ASME Diamond Jubilee Annual Meeting paper No. 55—A-51 (in type; to be published in the *Journal of Applied Mechanics;* available to October 1, 1956).

Plane-strain and axially symmetric approximate solutions for a perfect plastic are compared with experimental results obtained from the extrusion of a billet of commercially pure aluminum. The extrusion process was carried out at room temperature under essentially negligible external wall friction with a reduction of area of 87.8 per cent. It is found that the plane-strain solution is in good agreement with the experimental results, if a constant $k = \bar{\sigma}/2 = 20{,}000$ psi (maximum shear stress for Tresca's criterion) is substituted in the plane-strain solution.

The flow stress ($\bar{\sigma} \cong 40{,}000$ psi) was determined from a property test for the aluminum billet, at a strain equivalent to the uniform deformation in the extrusion (i.e., same area reduction without shear deformation). It is found that the Haar and von Karman yield condition is not valid for the present case, and further that the axially symmetric solution demonstrates no real advantage over the simpler plane-strain solution in predicting the stress distribution in an axially symmetric extrusion problem.

High-Frequency Extensional Vibrations of Plates, by T. R. Kane, University of Pennsylvania, Philadelphia, Pa., and R. D. Mindlin, Columbia University, New York, N. Y. 1955 ASME Diamond Jubilee Annual Meeting paper No. 55—A-50 (in type; to be published in the *Journal of Applied Mechanics;* available to October 1, 1956).

The equations of generalized plane stress are applicable to the extensional vibrations of plates only for the low modes of motion of thin plates. In this paper equations are derived which are applicable to both low and high modes of thin plates and to low modes of thick plates. As an example, the equations are solved for the case of axially symmetric vibrations of a circular disk and comparisons are made with the theory of generalized plane stress and with experiments.

A Study of Axisymmetric Vibrations of Cylindrical Shells as Affected by Rotatory Inertia and Transverse Shear, by T. C. Lin, formerly, Brown University, Providence, R. I., and G. W. Morgan, Brown University, Providence, R. I. 1955 ASME Diamond Jubilee Annual Meeting paper No. 55—A-59 (in type; to be published in the *Journal of Applied Mechanics;* available to October 1, 1956).

An analysis is presented of the problem of the propagation of axisymmetric waves in an elastic circular tube. The theory includes the effects of rotatory inertia and transverse shear in the same manner as does Timoshenko's theory of the vibrations of bars. These effects are of importance for waves at high frequencies; they tend to decrease the velocity of propagation and introduce an additional mode due to shear.

On the Ideally Plastic Indentation of Inset Rectangular Bands, by E. W. Ross, Jr., Watertown Arsenal Laboratory, Watertown, Mass. 1955 ASME Diamond Jubilee Annual Meeting paper No. 55—A-52 (in type; to be published in the *Journal of Applied Mechanics;* available to October 1, 1956).

One of the limit design theorems of ideal plasticity is applied to find an upper bound on the initial indentation pressure for the case where a flat, smooth die is pushed into an inset band of rectangular cross section. The dependence of the upper bound on the clearance and width of the band is given, and a possible extension to asymmetrically inset bands is suggested.

Plastic Deformation of Semi-Infinite Beams Subject to Transverse Impact Loading at the Free End, by M. F. Conroy, Boston College, Newton, Mass. 1955 ASME Diamond Jubilee Annual Meeting paper No. 55—A-49 (in type; to be published in the *Journal of Applied Mechanics;* available to October 1, 1956).

The object of this paper is to consider the plastic deformation of semi-infinite beams subject to dynamic transverse loading at the free end. The type of loading considered is that of a constant bending moment, together with a transverse force the magnitude of which is inversely proportional to the square root of time.

Part 1 of the paper consists of a plastic-rigid analysis of the problem, based on the plastic-rigid analysis of infinite beams under transverse, constant-velocity impact loading developed by the author.

Part 2 of the paper consists of an elastic-plastic solution of the problem, based on a theoretical analysis of the plastic deformation of infinite beams subject to transverse, constant-velocity impact loading developed by H. F. Bohnenblust. Specific problems are considered for which the deflection solutions obtained by elastic ideally plastic and rigid ideally plastic analyses are compared.

Propagation of a Sudden Rotary Disturbance in an Elastic Plate in Plane Stress, by J. N. Goodier, Stanford University, Stanford, Calif., and W. E. Jahsman, General Electric Company, Schenectady, N. Y. 1955 ASME Diamond Jubilee Annual Meeting paper No. 55—A-47 (in type; to be published in the *Journal of Applied Mechanics;* available to October 1, 1956).

Detailed results are found for two plane-stress problems of an elastic plate

with a hole from which a symmetrical disturbance is propagated. In the first a uniform shear stress is suddenly applied and maintained at the hole. In the second a uniform (rotary) velocity is suddenly applied and maintained. The subsequent motion is entirely rotary and involves shear stress only. The problems are mathematically analogous to those of symmetrical pressure and radial velocity at the hole, already solved by Kromm and his analysis is followed. The existence of a similar analogy in the statical cases is well known.

Creep Stresses and Deflections of Columns, by T. H. Lin, University of Detroit, Detroit, Mich. 1955 ASME Diamond Jubilee Annual Meeting paper No. **55—A-43** (in type; to be published in the *Journal of Applied Mechanics;* available to October 1, 1956).

A DIRECT method (no iteration is involved) of calculating stresses and deflection of a pin-ended column with creep is shown. The relaxation moment in a particular time interval is treated as an additional initial curvature of the column. This method is applicable to stress-strain-time relationship obtained directly from test data without the necessity of making restrictive assumptions.

An illustrative example is shown and the results are compared to those obtained by an iteration method and test data.

Stress distributions across different sections at different instants are shown. The stress distribution at mid-section deviates considerably from being linear as the creep deflection becomes large.

ASME Transactions

for December, 1955

THE December, 1955, issue of the Transactions of the ASME, which is the *Journal of Applied Mechanics* (available at $1 per copy to ASME members; $1.50 to nonmembers) contains the following:

Technical Papers

The Analysis of Dynamic Stresses in Aircraft Structures During Landing as Nonstationary Random Processes, by Y. C. Fung. (55—APM-32)

Large Deflection Analysis for a Plate Strip Subjected to Normal Pressure and Heating, by M. L. Williams. (55—APM-35)

A New Approach to the Analysis of Large Deflections of Plates, by H. M. Berger. (55—APM-36)

Elastic-Stress Waves Produced by Pressure Loads on a Spherical Shell, by J. H. Huth and J. D. Cole. (55—APM-31)

A Study of the Speed of Sound in Porous Granular Media, by H. Brandt. (55—APM-37)

Steady-State Behavior of Systems Provided With Nonlinear Dynamic Vibration Absorbers, by F. R. Arnold. (55—APM-30)

Free Oscillations of Systems Having Quadratic Damping and Arbitrary Restoring Forces, by Karl Klotter. (55—APM-34)

Perturbation Methods Applied to Nonlinear Dynamics, by Richard Bellman. (55—APM-33)

Aerodynamic Interference of Cascade Blades in Synchronized Oscillation, by Chich-Chien Chang and Wen Hwa Chu. (55—APM-16)

A Study of the Stability of Plane Fluid Sheets, by W. W. Hagerty and J. F. Shea. (55—APM-21)

Integral Methods in Natural-Convection Flow, by Salomon Levy. (55—APM-22)

Plastic Deformations of a Free Ring Under Concentrated Dynamic Loading, by R. H. Owens and P. S. Symonds. (55—APM-27)

Torsion of Circular Shafts of Variable Diameter, by M. M. Abbassi. (55—APM-19)

Large Plastic Deformations of Circular Membranes, by N. A. Weil and N. M. Newmark. (55—APM-20)

Stress Distribution in Square Plates With Hydrostatically Loaded Central Circular Holes, by A. J. Durelli and J. Barriage. (55—APM-12)

Force at Point in the Interior of a Semi-Infinite Solid With Fixed Boundary, by Leif Rongved. (55—APM-14)

Free Vibrations of Thin Cylindrical Shells Having Finite Lengths With Freely Supported and Clamped Edges, by Yi-Yuan Yu. (55—APM-13)

Buckling of Laminated Columns, by L. G. Clark. (55—APM-18)

Thin Circular Conical Shells Under Arbitrary Loads, by N. J. Hoff. (55—APM-29)

On the Nonlinear Oscillations of Viscoelastic Plates, by A. Cemal Eringen. (55—APM-15)

Forced Vibration of a Clamped Rectangular Plate in Fluid Media, by Gordon C. K. Yeh and Johann Martinek. (55—APM-24)

Nonlinear Dynamic Coupling in a Beam Vibration, by P. H. McDonald, Jr. (55—APM-23)

Some Solutions of the Timoshenko Beam Equations, by B. A. Boley and C. C. Chao. (55—APM-28)

Influence of Secondary Inertia Terms on Natural Frequencies of Rotating Beams, by J. L. Bogdanoff. (55—APM-17)

Discussion

Discussion on previously published papers by M. Kornhauser; A. P. Boresi; J. R. Schnittger; H. Zabronsky; C. F. Kettleborough; I. K. Silverman; T. C. Huang; S. I. Pai; H. T. Johnson; L. W. Hu and J. Marin; W. H. Hoppmann, 2nd; Martin Goland, P. D. Wickersham, and M. A. Dengler; and A. J. Durelli and C. H. Tsao.

Book Reviews

ASME Papers Order Form

Copies of ASME technical papers digested this month are available in pamphlet form. Please order only by paper *number;* otherwise the order will be returned. Orders should be addressed to the ASME Order Department, 29 W. 39th St. New York 18, N. Y. Papers are priced at 25 cents each to members; 50 cents to nonmembers. Payment may be made by check, U. S. postage stamps, free coupons distributed annually to members, or coupons which may be purchased from the Society. The coupons, in lots of ten, are $2 to members; $4 to nonmembers.

Note: No digests are made of ASME papers published in full or condensed form in other sections of MECHANICAL ENGINEERING.

Copies of all ASME publications are on file in the Engineering Societies Library and are indexed by the Engineering Index, Inc., both at 29 West 39th Street, New York, N. Y.

ASME Transactions and the *Journal of Applied Mechanics* are on file in the main public libraries of large industrial cities and in the technical libraries of engineering colleges having ASME Student Branches.

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The ASME Council Reports

Activities in 1954-1955

"Three quarters of a century ago a few far-sighted leaders founded The American Society of Mechanical Engineers to promote 'the arts and sciences connected with engineering and mechanical construction,' to provide means for the mutual and self-improvement of engineers, and to render greater service to mankind.

"In the years that have passed, the imagination, competence, and energy of our members, individually and in association with others who have given freely of their time and resources, have borne fruit in the glorious record of such accomplishments as engineers are fitted by genius and experience to attain in the advancement of peace and the material welfare of the free world.

"It is now my duty and privilege on behalf of the Council to proclaim 1955 as the Seventy-Fifth Anniversary of the Society, to be celebrated in an appropriate manner throughout the nation and throughout the year.

"By means of this celebration we rededicate the Society to the task of building our nation's engineering strength for greater service in the ever-widening fields of engineering application.

"In the spirit which animated our Founders we rededicate our Society—By Truth and by Service to Enrich Mankind."

THE foregoing words, delivered at the 1954 ASME Annual Meeting Banquet by Dr. David W. R. Morgan, the incoming President of the Society, opened the Diamond Jubilee Year commemorating the 75th Anniversary of the Society.

The general theme of the celebration was selected as the "Engineer in Our World" and various phases of this theme were dealt with at the national meetings: Communications at the founding anniversary in February; Education at the organization anniversary in April; Government at the Baltimore Spring Meeting; and Science at the Boston Semi-Annual Meeting. Commerce and Industry will be treated at the November Annual Meeting. At all of these meetings distinguished leaders in various fields participated in special panel discussions.

An international flavor was given to the celebration by the holding of the first international conference on Air Pollution in March and the international discussion on Combustion, jointly with The Institution of Mechanical Engineers, in June.

Special Features

As a special feature of the anniversary celebration, the Council authorized the bestowal of an increased number of honorary memberships, several of which were awarded to presidents of joint international bodies in recognition of the co-operation of other engineering societies. These included Sir Vincent de Ferranti, Chairman of the World Power Conference, Hilding Tornebohm, President of the International Organization for Standardization, and Georg Dithmer, Chairman of the Conference of Engineering Societies of Western Europe and U. S. A. The intimate relation of ASME with The Institution of Mechanical Engineers and The Engineering Institute of Canada was recognized by a similar bestowal on their presidents, Percy L. Jones and Richard E. Heartz. Other awards to eminent engineers outside U. S. A. were made to Sir Hugh Beaver (London), Jacob Ackeret (Zurich), and Ernest Mercier (Paris). Detlev Bronk, President of the National Academy of Sciences, and Vannevar Bush, President of the Carnegie Institution of Washington, also received honorary membership in ASME.

The bestowal of Society Medals was distributed among the meetings, the 1955 Holley Medal being presented to George Hood at Columbia, Mo., and the Spirit of St. Louis Medal to Ralph Damon at St. Louis.

The celebration of the anniversary was not confined to the national meetings. The Professional Division Conferences and the Section and Student Branch meetings devoted important attention to the anniversary. In each Section a special 75th Anniversary Medal was awarded to the member of that Section who had done most to further the work of the Society and in each Student Branch a special award was made to the outstanding engineering student at the college.

A motion picture was completed to dramatize to the general public the place of the mechanical engineer in our economy.

Supplementing all of these activities was an increased emphasis on public relations resulting in the preparation of a "Book of Facts" about the Society and its celebration which was distributed to the technical press, to the general press, to radio and television stations, and other recognized means of communication, as well as a large segment of top management in the industries employing mechanical engineers. The emphasis during the entire year has been to provide a better understanding of our profession and of the contributions of mechanical engineers and ASME to the American economy.

The seventy-fifth year seemed to be an appropriate time to review the aims and objects of the Society and take a look into the future. Accordingly, under the leadership of the Organization Committee, all elements of the Society, both technical and administrative, attacked the problem and presented their views which are being consolidated in a preliminary progress report for informal discussion at the 1955 Annual Meeting.

President Morgan and Secretary Davies, with President Glidden and Secretary Wisely of the American Society of Civil Engineers, represented U. S. A. at the Conference of Representatives of Engineering Societies of Western Europe and the U. S. A., which met at Copenhagen, Sept. 5–9, 1955. The agenda included subjects related to internal society operating problems. Engineering education, engineering-manpower supply and demand, and engineering abstracting services were the principal problems of broad interest that were taken up. Four days were devoted to serious consideration of the agenda in an atmosphere of understanding and good will. The meeting in Copenhagen provided the opportunity to bestow the Honorary Membership on Georg Dithmer, Chairman of the Conference. The presentation took place at the American Embassy.

The New Engineering Center

Five societies (ASCE, AIME, ASME, AIEE, and AIChE) agreed in 1954 to work out together the solution of the problem of a new office center for the engineering profession and a committee of the five presidents then in office was designated to make recommendations. Their recommendation that the center be located in Pittsburgh did not meet with the approval of all of the five boards, so a new approach was agreed upon. A task committee of fifteen, three from each society, to recommend a site completed its organization October 1 and held its first meeting shortly thereafter.

New Society Awards

The year saw the establishment of three new awards to be administered by the Society.

In October, 1954, the Society received a grant of $7000 from the Blackall Foundation and the Taft-Peirce Foundation to administer the Blackall Machine Tool and Gage Award, the deed of gift for which had been accepted the previous month. The Blackall Award was established to stimulate a continuing interest in ASME in the problems of machine-tools and gage, and dimensional-measuring-instrument design and application.

The deed of gift for the Arthur L. Williston Medal and Award was accepted in October, 1954. Mr. Williston has presented the Society with securities valued at $17,000 to support the award to be presented to a student or junior engineer who may submit a written proposal for improvement of undergraduate engineering curricula or environment that will improve the understanding of the mechanical-engineering student about the importance of participation in civic affairs.

In honor of Elmer A. Sperry, forty-eighth president of the Society, his daughter, Mrs. Robert Brooke Lea, and his son, Elmer A. Sperry, Jr., offered to ASME the administration of the Elmer A. Sperry Award, to be bestowed for a distinguished engineering contribution which has advanced the art of transportation by land, sea, or air, by a board with representation of four societies: ASME, the American Institute of Electrical Engineers, Society of Automotive Engineers, and the Society of Naval Architects and Marine Engineers. The Council accepted the offer and subsequently the Society received $16,000 in support of the Award.

The recipients of the 1955 Blackall and Sperry awards have been selected and awards will be bestowed at the 1955 Annual Meeting. The Williston Award will be offered in the fall of 1955 for selection of the recipient in the fall of 1956.

The Council takes this opportunity to recognize publicly the greatness of mind of these donors in their interest to stimulate the imagination and curiosity of inventive engineers whether in technical fields or the intangible areas of developing the professional spirit.

Council and Nominating Committee Reorganization

For several years there has been extensive discussion of ways to meet the need for the leadership in the Professional Divisions in the Codes and Standards committees and the administrative committees to have representation on the Council and in the Nominating Committee. The Council developed a plan which was submitted to letter ballot of the members on Sept. 27, 1954. The provisions which were approved are as follows:

1 Keeping the number of the Council at 22, as specified in the Charter, the number of past-presidents was reduced from five to three; the number of directors was increased from eight to ten, with four directors to represent the Board on Technology and the committees under its jurisdiction, two directors to represent the Board on Codes and Standards and the committees under its jurisdiction, and four directors to represent four administrative Boards and three administrative committees.

2 Three representatives, one from the technology group, one from the codes and standards group, and one from the administrative group, were added to the former nominating committee of eight, selected from one of the eight regions.

The new provisions were declared to be in effect when the tellers' report was read at the Business Session of the Society on Nov. 29, 1954, and the vacancies thereby created on the Council and Nominating Committee were filled immediately by the 1954-1955 Council for the current year. The selection procedures for the new members of the Nominating Committee were initiated smoothly and the elections for 1955-1956 put the entire plan into effect.

Remission of Initiation Fees

The Constitution of the Society gives the Council the power to remit the dues of any member for any special reason. The members by letter ballot approved a change in the Constitution to extend the same power to initiation fees, thus facilitating the agreement between ASME and the American Institute of Electrical Engineers by which a member of one society may become a member of the other without initiation fee. The Council has approved a similar agreement with the Engineering Institute of Canada, effective Oct. 1, 1955.

Membership Survey Questionnaire

The purpose of the ASME Membership Survey Questionnaire, mailed to 36,741 members in July, 1954, was to obtain facts about the members' specialized interests and activities in order to improve service to the membership. The responses received from 20,575 (56 per cent of those sent) serve as a basis for studies of improvement in Professional Divisions organization, publications policy, and program planning for National, Regional and Sectional Meetings, and Conferences. Complete

tabulations and certain special correlations of responses were distributed to members of the Council, Organization Committee, Board on Technology, Publications Committee, Professional Divisions Executive Committee, Meetings Committee, Board on Membership, Membership Development Committee; and to the Regional Committee chairmen and secretaries, chairmen and secretaries of Professional Divisions and Sections, and Delegates to the RAC Meetings. A summary of the responses appeared in the March and April, 1955, issues of MECHANICAL ENGINEERING.

The Technical Life of the Society

The Board on Technology has the responsibility for stimulating and co-ordinating the activities that promote the technical life of the Society through national meetings, publications, research, and Professional Divisions. Its responsibility also includes special projects related to these major subdivisions such as Air-Pollution Controls, Metals Engineering Handbook, *Applied Mechanics Reviews*, Lectureships, and Nuclear-Energy Application.

As one means of stimulation and co-ordination a Technology Executives Conference was held for two days in January, 1955, which brought together 60 representatives of the standing committees, the Professional Divisions, and the research committees to discuss policies and procedures. This Conference also provided the opportunity for convening the nominating meetings necessary to select names to be considered by the National Nominating Committee for Director.

The major problem facing the Board on Technology flows out of the tremendous increase in the literature requiring increased meeting time and publication space and dollars. Some progress is being made. The Board and its Committees were aided materially by the results of the ASME Membership Survey Questionnaire which were available early in 1955. Final conclusions should be forthcoming in 1956.

Meetings

Table 1 gives the data in the 18 national meetings and Professional Division conferences held during the year. Three Professional Divisions entered the list of annual conferences and will continue. The Annual Meeting again approached 8000 in attendance and the total recorded attendance showed an increase of 10 per cent over the preceding year. During the year 682 papers were presented compared to 606 in the previous year.

ASME Publications

The principal activity of the Publications Committee has centered around an intensive study of the problems of quantity and quality of papers for presentation at national meetings and division conferences. The preparation of more than 500 preprints per year and the selection and printing of those that are recommended for Transactions and *Journal of Applied Mechanics* places a heavy financial burden on the Society which is further aggravated by rising costs. How best to distribute this vast amount of technical literature so as to avoid waste, on the one hand, and provide adequate service to members on the other, constitutes another phase of the Committee's problem and responsibility.

An unusual accumulation of papers recommended for Transactions but not put into type because of lack of funds made it necessary for the Committee to request additional funds for Transactions. The amount requested, $40,000 in all, was granted by action of the Council.

The Committee is continuing its extensive studies to include not only current problems but future planning of all phases of the publications that come under its authority.

Two volumes of the Metals Engineering Handbook were issued during 1953-1954 and have been well received. The final two volumes are expected in 1955–1956.

Applied Mechanics Reviews has established itself as an authoritative and valuable publication to a limited list

Table 1 1954-1955 Meetings and Conferences

Meetings and Conferences	Number of Days	Sessions	Papers	Preprints	Attendance
ASME-ASLE Lubrication Conference, October 18–20, 1954, Baltimore, Md.	3	5	19	18	283
Fuels Conference, October 28–29, 1954, Pittsburgh, Pa.	2	2	6	4	375
Annual Meeting, November 28–December 3, 1954, New York, N. Y.	5	116	315	256	7,646
Founding Anniversary Meeting,[1] February 16, 1955, New York, N. Y.	1	..	..	..	224
Int. Congress on Air Pollution, March 1–2, 1955, New York, N. Y.	2	7	25	22	498
AIChE-Heat Transfer Symposium, March 20–23, 1955, Louisville, Ky.	3	..	..	..	100
Management Conference, March 23–24, 1955, Cleveland, Ohio.	2	4	12	11	201
Machine Design Conference, April 6, 1955, New York, N. Y.	1	2	7	7	106
Organization Anniversary Meeting,[2] April 16, 1955, Hoboken, N. J.	1	..	..	..	228
Diamond Jubilee Spring Meeting, April 18–22, 1955, Baltimore, Md.	4	31	82	49	1,007
Instruments & Regulators Conference, April 25–26, 1955, Ann Arbor, Mich.	2	4	8	8	120
Oil & Gas Power Conference, June 5–10, 1955, Washington, D. C.	4	9	15	13	600
Applied Mechanics Conference, June 16–18, 1955, Troy, N. Y.	3	7	29	29	136
ASME-I. Mech. E. Combustion Conference,[3] June 15–17, 1955, Cambridge, Mass.	3	5	18	(3)	403
Diamond Jubilee Semi-Annual Meeting, June 19–23, 1955, Boston, Mass.	4	41	96	80	1,348
IRD-ISA Conference & Exhibit, September 12–16, 1955, Los Angeles, Calif.	5	2	6	2	300*
Applied Mechanics Western Conference, September 12–13, 1955, Monterey, Calif.	2	4	13	8	100*
Petroleum Conference, September 25–28, 1955, New Orleans, La.	3	17	31	23	700*
	50	256	682	530	14,375

* Estimated.

[1] Special Meeting consisting of commemorating ceremony, panel session, and dinner.

[2] Special Meeting consisting of commemorating ceremony, luncheon, and panel session.

[3] Preprints prepared by I. M. E. in England.

of users. However, it receives large government subsidy which may be expected to decrease. Accordingly, the subscription rates have been increased and discount privileges withdrawn from other societies.

The publications program of ASME grows constantly. In addition to the regular periodical publications the Society last year prepared upward of 500 individual technical papers and maintained a stock of about 275 books, pamphlets, and the like. This represents a volume greater than that of any other engineering society.

In the fiscal year ending Sept. 30, 1955, the Society filled orders for more than 75,000 copies of its books, codes, and standards, 100,000 copies of ASME Technical Papers, in addition to the regular Society periodicals.

Orders came from engineers, industrial organizations, engineering schools, public libraries, and government bureaus globally.

The income from advertising and publications sales showed an increase of $5^1/_2$ per cent over that for 1953-1954.

Professional Divisions

Two new Professional Divisions were authorized, Nuclear Engineering and Lubrication.

Progress was made in promoting better Section cooperation and in clarifying the structure and relationships of the Professional Divisions. Substantial aid was given to the Publications Committee in its attack on the publications problem.

In addition to providing the major portion of the technical programs for the meetings shown in Table I the Professional Divisions made sound improvements in their internal organizations and methods of operation.

Lectureships

Excellent progress was made in the ASME lecture series by which outstanding authorities are made available through Sections and Student Branches to engineering audiences throughout the country. Seven excellent speakers met 57 groups and were received enthusiastically.

ASME Research

Nineteen research committees are extant, fifteen have active programs, the others are in stand-by. Good progress was reported by the committees on High Temperature Steam Generation, Effect of Temperature on the Properties of Metals, Fluid Meters, and Engineering Administration. The new program on Properties of Steam was under way in three laboratories as the year ended. Financial campaigns have been completed on Heat Conduction Charts and Mechanical Pressure Elements and laboratory work will soon start. Lubrication is engaged in surveys in its field relating to research. Boiler Feedwater Studies is reorganizing as an ASME committee, a change from its joint status with five co-operating bodies, and is preparing specific research proposals. Furnace Performance Factors is correlating past results and has completed plans for a full-scale furnace test. Corrosion and Deposits From Combustion Gases has a research program but action has been withheld pending correlation with results obtained in England. Thermal Conductivity of Gases is temporarily held up by the need for equipment reconstruction and calibration.

At the request of Army Ordnance, a new committee was established at the close of the year to undertake an analysis of methods used in shell forging and machining similar to that done in 1941–1947.

Some progress was made in securing the active interest of the Professional Divisions in suggesting research problems suitable for attack by ASME.

During the year $54,000 were spent on research. These monies were contributed by The Engineering Foundation and industry. The Custodian account contains $173,000 earmarked for further research programs at the end of the fiscal year.

Air-Pollution Control

In addition to sponsoring the First International Congress on Air Pollution, the Committee issued two important reports—one a revision of the report on Research in Air Pollution and the other on Instruments for the Study of Air Pollution, the first printing of which was quickly exhausted. *Smog News*, the Committee's news letter, was put on a subscription basis.

ASME Codes and Standards

The Board on Codes and Standards approved two new standards for transmittal to the American Standards Association for acceptance as American standards and approved three as ASME Standards. Twelve standards were presented to ASA for reaffirmation, no revision being required.

Two revised standards published during the year after long and arduous revision work which have important public interest are the American Standard National Plumbing Code and the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators. The Code for Pressure Piping was published in two volumes, the second dealing with Gas Transmission and Distribution Piping.

The name of the Boiler Code Committee was changed to the Boiler and Pressure Vessel Committee.

The Boiler and Pressure Vessel Committee held its field meeting in San Francisco jointly with the National Board of Boiler and Pressure Vessel Inspectors. A panel discussion on the work of the committee drew an attendance of 400. During the year, in addition to the publication of the usual addenda, the history of the Boiler Code Committee by the late Dr. Arthur M. Greene, Jr., was issued. The Committee finished work on the revision of the Sections of the Code that are to be published in 1956. The prices for issuing code symbol stamps and certificates was increased from $6 to $30 for three years.

The Power Test Codes Committee issued three revised codes: steam condensing apparatus, feedwater heaters, and evaporating apparatus. Ten additional codes are in various stages of writing or revision. The work of preparing the supplements on instruments and apparatus is proceeding vigorously. The Committee is reviewing its personnel and procedures.

ASME Work on International Codes and Standards

Members of six U. S. A. committees participated in a New York conference of representatives of Canada, Great Britain, and the U. S. A., April 11–15, 1955, devoted to the ABC program of unification of engineering standards. Gaging of screw threads, surface finish, and the extension of the unified threads to additional sizes were the prin-

cipal topics of discussion. Some agreements were found but the important value of the meeting was the development of procedures to simplify future work.

The Boiler and Pressure Vessel Committee holds the secretariat of ISO/TC11, a technical committee of the International Organization for Standardization dealing with international rules for boilers. The secretariat was represented at meetings of the four working subcommittees in Europe in February and March and in July; the secretaries of the subcommittees met in New York and formulated a draft skeleton code in preparation for a Second Plenary Session of ISO/TC11 in Madrid in February, 1956.

A meeting of the International Electrotechnical Commission is being held in Munich in June, 1956. In preparation for that meeting the committees for which ASME holds the secretariat (Hydraulic Turbines, Steam Turbines, and Internal-Combustion Engines) are preparing draft documents for consideration.

ASME, through its Fluid Meters Research Committee, is participating in an ISO/TC/30 project on Measurement of Fluid Flow, a meeting which was held in London in July, 1955.

Education and Professional Status

The Board on Education and Professional Status supervises several activities which at times are unrelated. However, this situation is under study and corrective measures are expected during the next year.

The principal concern of the Board and the Education Committee has been to develop policies and procedures to co-operate with the Engineers' Council for Professional Development in its program to improve the standards of mechanical-engineering education. The Education Committee staged a full day's discussion of the ECPD accrediting program at the 1954 Annual Meeting. As a result, criteria for selecting inspectors of curricula were developed and a plan of organization prepared so that ASME leaders would have direct opportunity to aid in the ECPD program.

The Engineers Registration Committee has pursued the ASME policy of attempting to secure larger understanding and participation of Sections and Student Branches in registration activities. A new series of informational pamphlets have been prepared for students and recent graduates.

The National Junior Committee, in its efforts to inform younger members of the opportunity the Society offers for self-development, conducts a forum in MECHANICAL ENGINEERING, holds sessions at Society meetings, organizes the junior advisers and observers to standing committees, and presents suggestions to the proper bodies for the better orientation of the younger Associate Members into the life of the Society. Good progress was made in all these activities during the year.

The Committee on Professional Practice of Consulting Engineering is a special committeee now in its second year. The Council approved (1) the policy suggested by the Committee condemning the practice of advertising for competitive public bids on a price basis for the performance of engineering services; (2) a standard form of agreement between mechanical engineers and architects. A Directory of Consulting Engineers is partially completed.

Membership

Table 2 shows the change in membership at the end of this year compared to the previous year.

The Board on Membership co-ordinates activities on admissions, review of special cases, and development.

During the year, the Admissions Committee made 3462 recommendations for membership; the Membership Review Committee considered 635 special cases, and the Membership Development Committee presented an accelerated program for membership increase which was approved by the Council in June, 1955.

Society Activity in the Regions

The services available to the members through the Sections and to the students through the Student Branches have been organized for the past ten years in eight regions each with a vice-president who is a member of the Council. In each region there are committees charged with stimulating Section activities, particularly in improved programs and membership development and with helping Student Branches in their activities. In both Section and Student Branch activities there is a Civic Affairs Committee working to improve participation in community activities. Each year, in each region, a Regional Administrative Committee is convened at which two representatives of each Section meet with the vice-president and the regional committees to promote Society activities in the region and to discuss a National Agenda of items suggested by members throughout the country and designed to improve Society operation nationally. The findings of each Regional Administrative Committee on this National Agenda were reviewed by the Regional Delegates Conference of sixteen, two from each region, which met at Boston June 19-20, 1955. The consolidated views of this conference were then presented to the Council which refers them to the responsible committees. The recommendations of the responsible agencies are acted upon by the Council, this year in October, and reported back to the entire chain of discussion. Some of the im-

Table 2 Changes in Membership—Sept. 30, 1954, to Sept. 30, 1955

	Membership		Increases			Decreases				Changes		
	Sept. 30, 1955	Sept. 30, 1954	Trans. to	Elected	Reinstated	Trans. from	Resigned	Dropped	Died	Increases	Decreases	Net change
Honorary	73	56	9	10					2	17		+17
Fellows	408	394	27			5	1		7	14		+14
Members	14538	14336	236	443	121	31	161	235	171	202		+202
Affiliates	301	316		15	1	1	10	10	10		15	−15
Associate Members (25.00)	3810	3587	417	134	63	115	66	197	13	223		+223
Associate Members (20.00)	4497	3164	2067	87	40	535	95	228	3	1333		+1333
Associate Members (10.00)	16832	17667		2240	40	2069	145	887	14		835	−835
Totals	40459	39520	2756	2929	265	2756	478	1557	220	1789	850	+939

portant policy recommendations presented to the Council included (*a*) steps to improve the unification of the profession; (*b*) changes in the charter so that the Society concern itself with the financial welfare of engineers; (*c*) a program to interest top management in the increased usefulness of engineers; (*d*) greater publicity about the Society research program, and a number of suggestions for changes in Society administrative procedures.

Each vice-president presents an annual report usually embodying the reports of the regional committees and the Sections. These reports are recorded in the reports to the Council.

All of the regional reports stressed the success of the Student Branch Conferences, twelve of which are held each spring, at which representatives of the 138 Student Branches present papers and discuss improved Student Branch operations. Older men who attend these conferences report that the students do a better job than the men in practice. Other matters stressed are improved working relations between Sections and adjacent Student Branches, improved programming, the importance of selecting proper faculty advisers to Student Branches, larger participation of members in Society activities, and a gratifying *improvement* in understanding the *importance* of participation in civic affairs.

Special regional activities worthy of note are:

Region I reports that two Student Branches, New Hampshire and Dartmouth, secured 100 per cent of the potential members. The Green Mountain Section area was enlarged to include members in Maine and the name was changed to the Northern New England Section.

Region II, formerly only the Metropolitan Section but now also including Plainfield and the Mid-Hudson Sections and two sub-sections, North Jersey and Long Island, is now in the throes of organizing itself as a region.

Region III reports acting as host to five important national Society events and a new Student Branch at Howard University.

Region IV has added one new Section, the Central Savannah River Area (CSRA), and one new subsection in North Alabama. Other subsections and groups are in process of formation.

Region V reactivated the Student Branch at Ohio Northern University.

Region VI reports that the Chicago and Milwaukee Sections are exploring the possibilities of subsections and groups for better service to members.

Region VII supported three meetings of national significance.

Region VIII established a new subsection at Shreveport and voted to abandon regional meetings after six years of trial in order to have national meetings held in the region.

ASME Co-Operation

It should be completely obvious that many programs in which ASME members are deeply interested are programs in which other engineering society members are interested. Close co-operation is required, and ASME is proud of its loyal adherence to the idea of working together on common problems of which there are a great many.

Joint programs, even though under the auspices of some joint body, are ASME programs worked on by ASME members, and good performance should be a matter of real pride to ASME members.

The reports on the joint programs are summarized in the following paragraphs under headings which classify the purposes of the co-operation.

Co-Operation in the Public Interest—Engineers Joint Council

Expansion of EJC. The number of member societies of EJC was increased from eight to ten by the addition of The American Society of Refrigerating Engineers and The American Institute of Industrial Engineers, the latter as an associate. Inquiries have been received indicating interest by societies eligible for the various categories of membership.

General Assembly. The first General Assembly of EJC was held on Jan. 25, 1955, with 322 persons registered. Among the principal subjects covered in panel discussions were nuclear-engineering developments, employment conditions and unionization, engineering manpower, and the service opportunities of EJC. At both the luncheon and dinner meetings prominent speakers gave addresses on subjects of general interest to the engineering profession. The success of the first General Assembly has caused the Council to schedule a two-day assembly for 1956.

National Water Policy Panel. Events during the year have highlighted the exceptional professional significance of the sound provisions developed by the Panel in its "Principles of a Sound National Water Policy." EJC has reaffirmed its previous action in "authorizing its National Water Policy Panel to take any steps it considers desirable to bring the Principles of a Sound National Water Policy to the attention of legislators and other interested persons." Under this endorsement the panel has accepted many opportunities to advance its policies before the Hoover Commission and governmental groups.

National Engineers Register. Under a grant of funds from the National Science Foundation, the National Engineers Register was placed in operation in June, 1954, and has completed the registering of approximately 12,000 qualified engineers.

A review of the existing Register indicates that a total of 15,000 to 18,000 engineers will be sufficient to provide adequate coverage in all fields of engineering specialization.

The completed Register will be used as a "finders list" to locate specialists in any required field of engineering in the event of a national emergency. The Register will be used to locate specialists as sources of technical information to aid in the development of special projects as directed by the government and not as an employment list.

Committee on International Relations. UPADI[1] headquarters in Montevideo has appointed committees to redraft the UPADI Code of Ethics and the UPADI Convention Rules. William N. Carey is on the former committee and A. J. Ackerman, Steward E. Reimel, and Austin Wright (Canada) are on the latter.

The Committee was represented at the Fourth Petroleum Congress in Rome, June 5 to 16, by Dean William H. Carson and at the International Congress of Refrigeration in Paris, August 13 to September 15, by Dr. Richard C. Jordan.

[1] Pan-American Union of Engineering Societies.

During the year EJC assumed the secretariat for the United States Committee on Large Dams. Stewart E. Reimel was appointed the USCOLD secretary-treasurer.

During September EUSEC (Conference of Representatives of Engineering Societies from Western Europe and the United States) scheduled a meeting in Copenhagen. Previous work on abstracting, engineering definitions, and other subjects were further advanced at this meeting.

EJC has been requested to continue as a representative on the U. S. National Committee for UNESCO for another three years. Ralph L. Goetzenberger has been reappointed as the EJC representative on this committee.

National Engineers. The Washington Task Group has been working with the Smithsonian Institution in connection with plans for a new building to house the Museum of History and Technology. Funds have been appropriated by the Congress to develop detailed plans for this new building.

Engineering Manpower Commission. Founded in 1951, the Engineering Manpower Commission continued in 1955 its program to aid in establishing the importance of engineers to the national economy and security, to aid in maintaining the supply of trained engineers, and to promote the most effective utilization of engineers in maintaining the national health, safety, and interest.

1955 was a year in which important policy decisions were made in both the Congress and the Executive Branch of the government concerning plans for the utilization of engineering manpower during the period of cold war and during time of more complete mobilization. EMC participated effectively in these developments to insure that our nation's resources of engineers would be permitted in time of stress to make their highest and most effective contribution to the national welfare. In addition, during 1955, EMC pursued many other specific approaches toward its stated goals.

Nuclear Engineering and Science Committee. In 1954 the Nuclear Engineering and Science Committee was established to organize the Nuclear Congress under the sponsorship of EJC. This Committee enlisted the cooperation of a total of 24 engineering and scientific societies including the member societies of EJC. During the current year this Committee completed the program for a Congress, and as of Sept. 1, 1955, a total of 255 papers have been accepted for presentation. The Congress will be held in Cleveland, Ohio, Dec. 12 to 16, 1955. Concurrent with the Congress will be an International Atomic Exposition sponsored by the American Institute of Chemical Engineers. The Cleveland Engineering Society and the Cleveland Technical Societies Council, the latter representing local sections of all national societies, are acting as co-hosts for the Congress.

Co-Operation With the National Bureau of Standards. In the spring of 1954 the ASME Technical Advisory Committee to the National Bureau of Standards held its first meeting and during the past year held a meeting with the corresponding ASCE committee at the Bureau. The usefulness of the ASME committee has been established particularly in connection with the Divisions of the Bureau on Heat and Power, Mechanics and Optics, and Metrology.

Co-Operation in Engineering Education—Engineers' Council for Professional Development

The Guidance Committee distributed to 35,000 secondary schools a copy of "After High School, What?" A third edition is under way for distribution next year. Local and state guidance work was strengthened, and the organization is being expanded to meet needs in various areas. In addition, societies, companies, and Engineering Manpower Commission bought copies of "After High School, What?" ASME and AIEE printed the copies they distributed.

The Education Committee made inspections, for action at the annual meeting of ECPD in Toronto, Canada, Oct. 13–14, 1955, of curricula in 88 institutions. The "cognate" curricula statement was studied, and a revised statement was approved in principle and distributed to societies for consideration in October. Active collaboration or co-operation with regional associations is being carried forward.

The training Committeee reported that the program initiated in Cincinnati is proceeding and groundwork is prepared for a similar program in Detroit. Emphasis is on orientation and training. The Engineering Society of Detroit junior group is working on a "Newcomers Guide."

The Information Committee supervised the printing of the Annual Report, the standard list of accredited curricula leading to first degrees in engineering, and a list of accredited technical-institute programs in a new format. The "Professional Guide for Junior Engineers" (W. E. Wickenden) was reprinted with the "First Five Years" brochure of six pages added. To meet an order for 1000, "The Most Desirable Personal Characteristics" was reprinted. The mechanical-engineering section of the Selected Bibliography of Engineering Subjects is being set in type.

The Student Development Committee is working on two tasks: (1) a statement on professionalism to be used by faculty and students, and (2) a study of a joint organization for student chapters of the professional-technical engineering societies. Recommendations will be made at a later date.

The Professional Recognition Committee met several times and discussed a definition of engineering, uniform application forms, and the practice of engineering by corporations.

A group of deans who met in Ithaca in June, 1954, proposed an extended study of education and the utilization of engineers, parallel to the Flexner study of the medical field early in the century. ECPD has considered the matter, first through its vice-president, and now through a special group which will form a panel for discussion of this subject at the October annual meeting.

Preparatory to the Third EUSEC Conference on Engineering Education and Training being held in Paris in September, 1956, ECPD has appointed a working committee to assist on the various assignments and the questionnaires on which reports are to be made.

Co-Operation in Advancing Engineering Science

Engineering Societies Library. A collection of 172,000 volumes and a photoprint, microfilm, translation, and search service, are being used by an increasing number of persons who requested help in visits or by mail, phone, or wire. The Library sponsors the Engineering Society Monograph Series and represents ASME on the American Documentation Institute.

The Engineering Foundation for the furtherance of research and the advancement of the profession, in the 40 years of its life, has contributed $1,000,000 of direct

financial support to 120 projects which in turn have evoked industrial support of over $13,000,000. The Foundation supported ECPD and the following ASME projects: properties of steam, properties of gases, lubrication, heat-conduction charts, effect of temperature on metals, high-temperature steam generation, and corrosion from combustion gases.

International Organization for Standardization is referred to under "ASME Work on International Codes and Standards."

International Electrotechnical Commission celebrated its 50th anniversary at Philadelphia in September, 1954, attended by 800 delegates from 21 nations. For ASME participation see "ASME Work on International Codes and Standards."

World Power Conference. The U. S. National Committee has completed its contribution to the Plenary Session in Vienna, June 17–23, 1956, by the acceptance of 25 technical papers prepared by 34 authors.

Council for International Progress in Management. The U. S. National Committee for the International Committee on Scientific Management (CIOS) received two study teams from Europe and sponsored five U. S. A. seminar teams to Europe and Japan, supported by government. A privately sponsored seminar program was conducted in Finland. A Pan-American group of societies is planning a hemispherical management conference in Canada in 1958.

U. S. National Committee on Theoretical and Applied Mechanics. The U. S. A. body in the International Union of Theoretical and Applied Mechanics is now planning U. S. A. participation in an international congress in Brussels in 1956 and is arranging the third U. S. National Congress at Brown University in 1958.

Section "M" (Engineering) American Association for the Advancement of Science, provided a program for the Berkeley meeting of AAAS, December, 1954.

The Institution of Mechanical Engineers (London). ASME has a program of active co-operation with I. M. E. A successful International Discussion on Combustion was held in Cambridge, Mass., in June, 1955. Joint conferences on Fatigue and Lubrication are contemplated.

ASME-EIC International Council, responsible for promoting the mutual interests of The Engineering Institute of Canada and ASME, staged a successful joint discussion on engineering education at Potsdam, N. Y., in October, 1954, and is planning a similar conference in Ontario in the fall of 1956. ASME has a representative on the EIC Council. Plans for a joint meeting of the two bodies in Montreal in May, 1956, are completed.

API-ASME Committee on Unfired Pressure Vessels has continued to issue interpretations of the 1951 edition of the joint code.

American Rocket Society, affiliated with ASME, participates extensively in ASME meetings. A more definitive description of the affiliation arrangements is under discussion.

Co-Operation in Building and Joint Funds

United Engineering Trustees, Inc., manages and maintains the Engineering Societies Building in New York and cares for the endowments for the Building, the Engineering Societies Library, The Engineering Foundation, the John Fritz Medal, and the Guggenheim Medal, and serves as treasurer for the Engineers' Council for Professional Development.

Co-Operation in Service

Engineering Societies Personnel Service, Inc., is a placement service for engineers with offices at New York, Chicago, Detroit, and San Francisco.

National Bureau of Engineering Registration is an agency of the National Council of State Boards of Engineering Examiners to facilitate engineering registration in more than one state. 1795 Certificates of Qualification have been issued, 153 during the year ending June 30, 1955.

ASME Woman's Auxiliary

The Woman's Auxiliary reports 1371 members and eighteen sections, with another in Honolulu in the process of organization. The Calvin W. Rice Memorial Scholarship of $1500 went to a student from Lebanon. Sylvia W. Farny scholarships of $500 each were awarded to students at Missouri School of Mines and Metallurgy and at Northeastern University. In the Student Loan Fund, 32 loans totaling $11,905 are outstanding.

"Old Guard" Committee

This committee, made up of members who by length of membership are dues-exempt, collects monies from dues-exempt members and expends them in aiding students and younger members in ways for which Society funds cannot be used. The response this year has been so good that the Committee is entering on an expanded program. This Committee is self-organized and does not report directly or indirectly to the Council but it is performing a useful service for which the Council is appreciative.

Services of ASME Committees

The administrative work of the Society takes the time of many busy members whose efforts contribute much to the success of the Society. To them the Council expresses its deep appreciation and reports briefly about their work.

Finance Committee administers the Society investment policy and watches income and expense. A following document gives their report.

Organization Committee is concerned about the effectiveness of the committee organization, scrutinizes committee appointments for the Council, and this year, with the approval of the Council, initiated a review of Society aims with a view to establishing long-range objectives and charting a course for future development.

Constitution and By-Laws watches over Society law.

Pension Committee supervises the employees' retirement plan.

Society Policy Committee recommended that the Society assume more leadership in improving mechanical educational standards. This was approved and the Board on Education and Professional Status and the Education Committee have taken appropriate action.

Board on Honors and Medals Committee recommended to the Council the names of 25 recipients of distinguished honors and seven prizes for outstanding achievements.

Board on Public Affairs is concerned with co-operation with government and with Society policy on international relations.

Civic Affairs Committee is stimulating increased participation in civic affairs.

Record of the Council, the President, and the Secretary's Office

Council and Vice-Presidents' Meetings. The Council held two meetings during the year, at the Annual Meeting in New York, Nov. 28–29, 1954, and in Boston, Mass., June 19–20, 1955. Meetings of the Vice-Presidents were also held during those meetings and a third one, at Society headquarters Feb. 17–18, 1955. The Executive Committee of the Council held eight meetings.

President's Visits. At the close of his administrative year the President will have attended meetings of 35 Sections, 18 Student Branches, and 4 joint meetings of Sections and Student Branches. In addition, he attended the Annual Meeting in New York, the 75th Anniversary Meetings at McGraw-Hill Company, Inc., New York, and at Stevens Institute of Technology, Hoboken, the Spring Meeting in Baltimore, and the Semi-Annual Meeting in Boston; Student Conferences in Houston, Texas, Berkeley, Calif., and Corvallis, Ore.; five Divisional Meetings; Technology Executive Conference in Pittsburgh, Management Conferences in Cleveland and Skytop, Oil and Gas Power Conference, in Washington, D. C., Petroleum Mechanical Engineering Conference in New Orleans; the First International Air Pollution Conference in New York, the ASME-I. M. E. Combustion Conference in Cambridge, and the EUSEC session in Copenhagen.

Deaths. During the fiscal year, the following deaths were recorded:

Robert B. Wolf, Vice-President, 1920–1922, died November 10, 1954.
Benjamin P. Graves, Director at Large, 1949–1953, died Nov. 11, 1954.
David S. Jacobus, President 1916, Honorary Member, died Feb. 11, 1955.
Ernest F. Mercier, Honorary Member, died July, 1955.
C. E. Gorton, Manager 1925–1928, Vice-President, 1928–1930, died Aug. 20, 1955.

Secretary's Staff. John H. Deppeler, who served as secretary of the Boiler and Pressure Vessel Code Committee over a period of five years, retired last year and John D. Wilding succeeded him. Also, Spencer W. Reynolds was added to the staff of the Boiler and Pressure Vessel Code Committee as assistant to Mr. Wilding.

Edna M. Murrayes, Mae Lenen, and Joseph Clark completed thirty-five years of service with the Society, and Florence M. Schonger completed thirty years.

Committee Reports

The reports to the Council from Committees and delegates to joint bodies from which this report was compiled, are published in a pamphlet which is distributed at the Business Session when this report is presented and is available to others on request. They form an inspiring record of the work of hundreds of individuals who have worked hard to support a great Society in its important activities on a broad front.

1954–1955 Council

DAVID W. R. MORGAN, *President*

Past-Presidents

R. J. S. PIGOTT — FREDERICK S. BLACKALL, JR.
LEWIS K. SILLCOX

Vice-Presidents

WILLIS F. THOMPSON (I) — WILLIAM H. BYRNE (II)
WILLIAM G. MCLEAN (III) — JAMES B. JONES (IV)
THOMPSON CHANDLER (V) — BEN GEORGE ELLIOTT (VI)
VERNON A. PETERSON (VII) — CLIFFORD H. SHUMAKER (VIII)

Directors

E. O. BERGMAN (C) — RALPH L. GOETZENBERGER (A)
J. H. DAVIS (T) — FRANK L. BRADLEY (A)
ALBERT C. PASINI (T) — ROBERT B. LEA (T)
LOUIS POLK (C) — GEORGE A. HAWKINS (T)
JOSEPH POPE (A) — HAROLD C. R. CARLSON (A)

ASME Finance Committee

Report for 1954-1955

REFLECTING the generally high level of the national economy, the Society has just completed the biggest year in its financial history. Gross income for the fiscal period ending September 30, 1955, was $1,918,512.24, up slightly more than $100,000 from the preceding year. With an expanded program of services, and somewhat higher operating costs, total expenses also increased—to $1,865,792.25. But with income growing at a faster rate than expense, the net was an encouraging $52,719.99.

For fiscal 1955-1956 the Finance Committee has studied and recommended to the Executive Committee a conservative budget. Anticipating a generally tighter business situation, income has been estimated at a lower level than for record-breaking 1954-1955. To produce an over-all balance, expenses are budgeted accordingly.

Since 1951 the Finance Committee, with the approval of Council, has been following a program of increasing the diversification of the Society's investments. Stated briefly, the over-all objective has been to maintain the relative competitive effectiveness of the Society's capital under varying price levels and economic conditions.

Early in 1955 the performance under this program was analyzed with our investment counsel. Since 1951 there have been important additions to capital and the value of the Society's holdings has appreciated substantially. As a result of a continuing effort to keep all funds (beyond those needed for current operations) working with full effectiveness, and of the diversified investment program with its higher yields, income from investments has more than doubled since 1951.

During the year, the Committee and its counsel have continuously examined the changing investment situation and made changes in the Society's portfolio, working always in the direction of reaching the general distribution of types of securities outlined in recommendations approved by Council in June, 1954. This distribution, published in last year's report of the Finance Committee, was based on common-stock holdings varying from 20 to 40 per cent of the total portfolio. As of September 30, 1955, the common-stock holdings in the portfolio were close to the median of this range, being 28 per cent of the total.

Acquisition of common stocks to reach this planned level has had to be a gradual and cautious process. With the securities market at generally high levels, the task of seeking out those investments that are relatively undervalued calls for patient study and searching analysis. In this continuous sifting, the Committee has received invaluable aid from its counsel. The situation as of Sept. 30, 1955, is:

	Group 1 Working Capital	Group 2 Working Capital	Total Working Capital
Cash	$199,335.74	$263,227.39	$462,563.13
	Special Portfolio	General Portfolio	Combined Portfolio
U. S. Treasury Bonds	$101,767.19	$ 387,353.13	$ 489,120.32
U. S. Savings Bonds		275,360.00	275,360.00
Corporate Bonds		281,850.81	281,850.81
Preferred Stocks	24,419.33	108,976.42	133,395.75
Common Stocks		325,115.05	325,115.05
	$126,186.52	$1,378,655.41	$1,504,841.93
Grand Total	$325,522.26	$1,641,882.80	$1,967,405.06

For some time the Finance Committee has felt that means should be developed for using some portion of investment income to build a "cushion" against the always present possibility of future declines in security values. As a result of a study made by a subcommittee, the following recommendation was approved by the Executive Committee: "Investment income received by the General Fund shall be allocated by Council on recommendation of the Finance Committee, allocating a portion of such income to the general income of the Society and crediting the balance, if any, to surplus; said allocation to be made prior to the closing of each year's books.

This subcommittee on investments also studied the position of the various special funds that have been set up in the past to maintain awards and for other specific purposes. In order that these "trust" funds might share equitably in the improved earnings and capital gains resulting from diversified investment of the Society's general funds, the subcommittee sought means of grouping the special or "trust" funds in a pool for common investment handling.

Working with the advice of the Society's legal counsel and auditors, the subcommittee developed recommendations that will permit managing the "trust" funds as a group under the supervision of professional investment counsel, with the expectation of financial benefits to all.

Under this new procedure, the determination of the share of each "trust" fund in the principal and earnings of the pool will be made on the basis of the present market value of each individual fund. In the future, market values and ratios will be determined at the start of each fiscal year, and at each time an additional fund enters the pool. Distribution of income will be made at the end of the fiscal year.

The Finance Committee also recommended, and the Executive Committee approved, a policy of full investment for the funds in this pool—no more than 2 per cent of the total assets to be in cash or U. S. Treasury Bills.

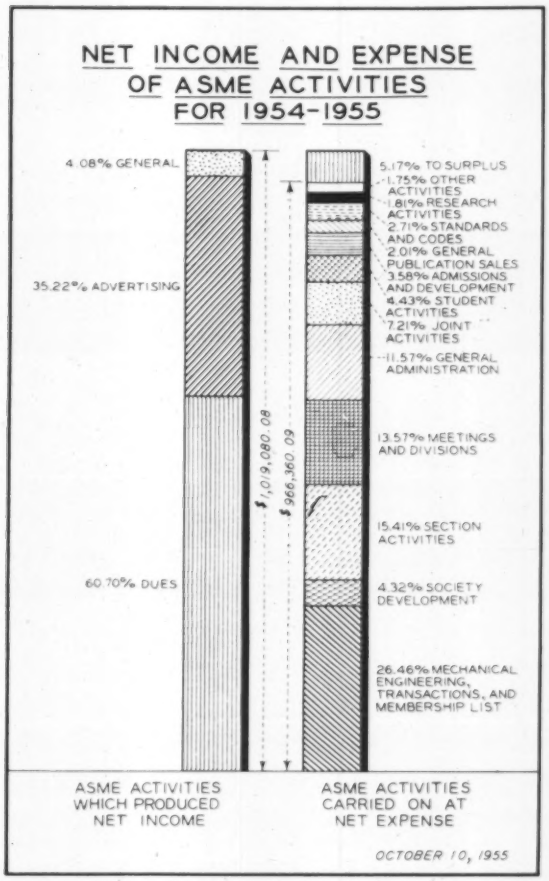
With these changes, the Finance Committee believes that procedures are now in being for flexible and efficient investment of the Society's capital in accordance with the previously stated objective of maintaining a sound position under changing economic conditions.

While the Committee may set general policies and goals, the facts and figures on which decisions are made come from the staff, and the successful accomplishment of desired objectives depends on the competence, assiduousness, and loyalty of those charged with the administration of the Society's financial affairs.

So members may gain a clear picture of the Society's finances, the staff has prepared the diagrams and figures on following pages. The attention of the membership is respectfully directed to them.

Respectfully submitted,

L. N. Rowley, Jr., *Chairman*
H. J. Bauer, *Vice-Chairman*
J. O. Amstuz
F. B. Turck
H. E. Martin
Joseph Pope
H. R. Kessler
J. L. Kopf
E. J. Kates



ASME Finances[1]

THE INCOME of the Society for the year ending September 30, 1955, of $1,918,512.24, was the largest in the history of the Society. A net income over expense of $52,719.99 is reported. This amount, plus initiation and transfer fees amounting to $21,040.00, makes a total addition to surplus for the year of $73,759.99.

The balance sheet of September 30, 1955, shows, on that date, that the Society owed:

(1) Current bills and federal tax withheld from employees	$ 23,212.49
(2) Obligations for printing and distributing the 1956 Mechanical Catalog and other bills which have not been submitted	53,159.34
(3) Unexpended appropriations for future services	192,202.52
(4) Future services to members who have prepaid dues	272,527.50
(5) Subscriptions paid in advance	5,500.00
	$546,601.85

[1] The certified report of the auditors, Price Waterhouse and Co., is on file in the Society's office and is available for inspection by the members of the Society.

To meet these debts the Society had:

(1) Cash in the bank	$ 176,289.68
(2) Accounts receivable	142,803.40
(3) Inventories of publications and supplies conservatively valued at	200,520.86
(4) Securities (at the lower of cost or approximate quoted market values)	1,060,363.61
	$1,579,977.55

The difference between the value held by the Society of $1,579,977.55 and debts of $546,601.85 is the net worth of the Society on September 30, 1955 ..... $1,033,375.70

Against this the Society has set aside a General Reserve against contingencies ..... $ 675,000.00

This leaves a surplus of ..... $ 358,375.70

The Society administers a number of special funds. The condition of these is shown below:

(1) Custodian Funds

Special research and other committees which have collected funds for special services to be expended as needed ..... $ 298,617.44

Against which it had:	
(a) Cash	$197,469.98
(b) Securities (at cost value)	101,147.46
	$298,617.44

(2) Development Fund of ..... $ 26,904.82

Against which it had:	
(a) Cash	$ 1,865.76
(b) Securities (at cost value)	25,039.06
	$ 26,904.82

(3) Employees' Retirement Fund of ..... $ 150,821.72

Against which it had:	
(a) Cash	$ 30,344.53
(b) Securities (at cost value)	120,477.19
	$150,821.72

(4) Trust Funds amounting to ..... $ 256,830.79

Against which the Society had the following assets:	
(a) Cash	$ 56,593.18
(b) Securities (at cost value)	197,814.61
(c) Notes receivable	2,423.00
	$256,830.79

The Engineering Building is owned jointly by the major societies through United Engineering Trustees, Inc. ASME interest, and other long-term assets, are treated as a fully reserved fund:

(1) Property Fund of		$ 608,675.92
With these assets to support it:		
(*a*) ASME quarter interest in real estate and certain other assets of the United Engineering Trustees, Inc.	$498,448.48	
(*b*) Office furniture and fixtures (depreciated value)	110,226.44	
(*c*) Engineering Index, Inc., Title and good will	1.00	
	$608,675.92	

Table 3 shows Society operations which produce net income and those which result in net expense. Table 4 shows income and expense by major groupings of Society activities.

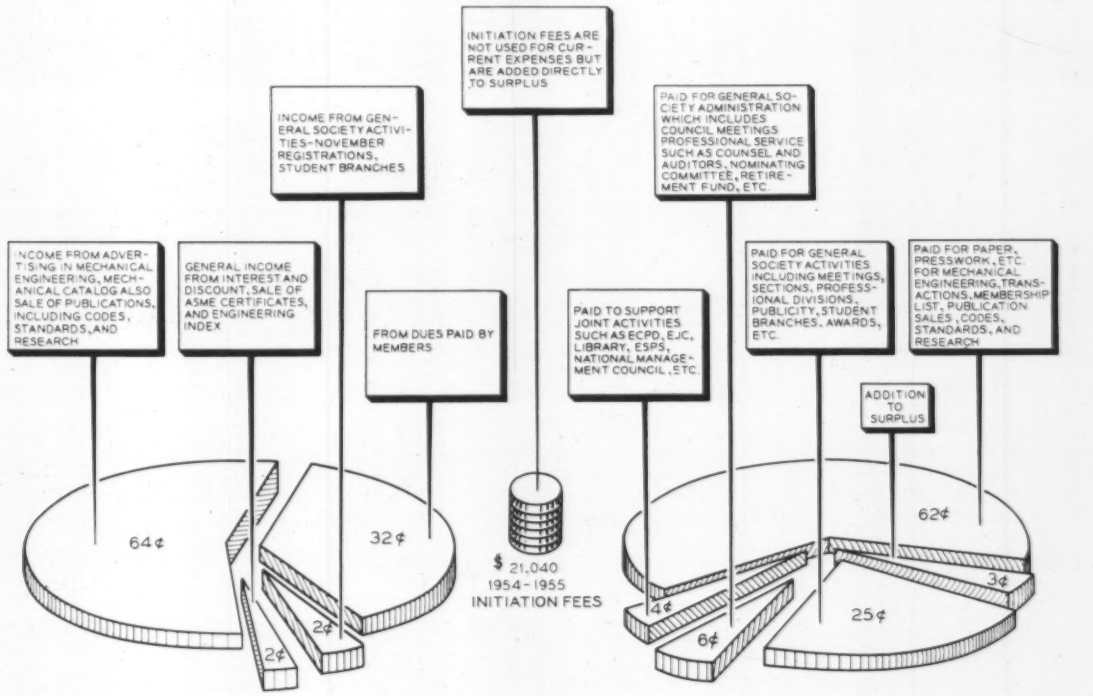
Table 3 Analysis of Income and Expense

(In this analysis, each expense item includes an allocated share of the indirect expense)

A	*Income items against which no charges are made*		
1	Membership Dues		$ 618,558.81
2	Interest and Discount		35,254.25
3	Miscellaneous Sales		3,825.41
4	Engineering Index, Inc.		2,500.00
			$ 660,138.47
B	*Activities which produce a net income*		
1	Advertising in MECHANICAL ENGINEERING and Mechanical Catalog	$868,767.14	
	Less: Expenses for producing advertising pages and selling the advertising	509,825.53	
			358,941.61
			$1,019,080.08
C	*Activities with some income which result in a net expense*		
1	General Publication Sales Income	$ 93,009.54	
	Less: Cost of producing publications sold, mailing cost, and selling cost	113,477.37	
			$ 20,467.83
2	Standards and Codes Income (from sales of publications)	$205,930.88	
	Less: Cost of producing codes and standards sold, mailing cost, selling cost, and servicing of committees.	233,595.17	
			$ 27,664.29
3	Research Income (from sales of research reports)	$ 4,476.04	
	Less: Cost of producing research reports sold, mailing cost, selling cost, and servicing research committees	22,938.44	
			$ 18,462.40
4	Transactions and *Journal of Applied Mechanics*' Income (from subscription sales)	$ 50,960.77	
	Less: Cost of producing Transactions and *Journal of Applied Mechanics* sold, mailing cost, and selling cost, plus free copies for depositories	137,106.12	
			$ 86,145.35
5	Student Dues	$ 29,811.00	
	Less: Appropriations to Student Branches, cost of 12 student-branch conferences, cost of copies of MECHANICAL ENGINEERING mailed to students, and cost of office services	74,977.60	
			$ 45,166.60
6	Meetings Income (from registration fees)	$ 5,418.40	
	Less: Cost of meetings and cost of office service	102,925.36	
			$ 97,506.96
D	*Activities Expense against which no income is credited*		
1	MECHANICAL ENGINEERING text pages (costs of printing and editorial)		$ 175,423.49
2	Membership List (cost of compiling, printing, and editorial)		8,121.87
3	Sections (appropriations to Sections, costs of Regional Administrative Committees, cost of Regional Delegates Conference, travel in Regions, cost of office service, and costs of national lectureships)		157,020.17
4	Professional Divisions (appropriations to Professional Division and office costs)		40,751.46
5	Admissions and Development (office costs for Admissions Committee and Membership Development Committee)		36,508.16
6	Awards (cost of medals, prizes, and certificates, and office service)		4,354.81
7	Joint Activities (appropriation for Library, ECPD, EJC, etc.)		73,427.25
8	General Administration (expenses of the Council, Retirement Fund, and office service)		117,872.95
9	Society's 75th Anniversary		5,798.87
10	Organization Charts		1,167.63
11	Civic Affairs Committee		500.00
12	Lectureships		6,000.00
13	Society Development		44,000.00
			$ 966,360.09
	Net Income		$ 52,719.99

Table 4 Total Income and Expense for Major Groups of Society Activities

	Expense	Income	Net	Expense per member	Income per member	Expense per member
Dues	....	$ 618,558.81	+$618,558.81	....	$15.29	....
General Income (interest, discount, emblem sales, Engineering Index, Inc.)	....	41,579.66	+ 41,579.66	....	1.03	....
Publications, Standards, Codes, and Research	$1,201,655.62	1,223,144.37	+ 21,488.75	$29.70	30.22	+$ .52
General Society Activities (meetings, sections, student branches, admissions, etc.)	472,836.43	35,229.40	− 437,607.03	11.69	.87	10.82
General Society Administration (Council, auditors, counsel, retirement fund)	117,872.95	....	− 117,872.95	2.91	....	2.91
Joint Activities (Library, ECPD, EJC, ASEE, etc.)	73,427.25	....	− 73,427.25	1.81	....	1.81
Addition to surplus from operating income	52,719.99	....	....	1.30	....	1.30
Total	$1,918,512.24	$1,918,512.24	....	$47.41	$47.41	$16.32
Addition to surplus from initiation fees		21,040.00				
Total addition to surplus		73,759.99				


INITIATION FEES ARE NOT USED FOR CURRENT EXPENSES BUT ARE ADDED DIRECTLY TO SURPLUS
INCOME FROM GENERAL SOCIETY ACTIVITIES-NOVEMBER REGISTRATIONS, STUDENT BRANCHES
INCOME FROM ADVERTISING IN MECHANICAL ENGINEERING, MECHANICAL CATALOG ALSO SALE OF PUBLICATIONS, INCLUDING CODES, STANDARDS, AND RESEARCH
GENERAL INCOME FROM INTEREST AND DISCOUNT, SALE OF ASME CERTIFICATES, AND ENGINEERING INDEX
FROM DUES PAID BY MEMBERS
64¢
32¢
2¢
2¢
$ 21,040
1954-1955
INITIATION FEES
PAID FOR GENERAL SOCIETY ADMINISTRATION WHICH INCLUDES COUNCIL MEETINGS PROFESSIONAL SERVICE SUCH AS COUNSEL AND AUDITORS, NOMINATING COMMITTEE, RETIREMENT FUND, ETC.
PAID TO SUPPORT JOINT ACTIVITIES SUCH AS ECPD, EJC, LIBRARY, ESPS, NATIONAL MANAGEMENT COUNCIL, ETC.
PAID FOR GENERAL SOCIETY ACTIVITIES INCLUDING MEETINGS, SECTIONS, PROFESSIONAL DIVISIONS, PUBLICITY, STUDENT BRANCHES, AWARDS, ETC.
PAID FOR PAPER, PRESSWORK, ETC. FOR MECHANICAL ENGINEERING, TRANSACTIONS, MEMBERSHIP LIST, PUBLICATION SALES, CODES, STANDARDS, AND RESEARCH
ADDITION TO SURPLUS
62¢
3¢
4¢
6¢
25¢

WHERE ASME INCOME DOLLAR COMES FROM

TOTAL INCOME-1954-1955-$1,918,512.24

HOW THE ASME INCOME DOLLAR WAS SPENT

TOTAL EXPENSES 1954-1955 − $1,865,792.25*

*ADDITION TO SURPLUS $ 52,719.99

ASME 75th Anniversary Annual Meeting Completes Cycle on the "Engineer in Our World" Theme

Special commemorative events spark highly significant technical program of 300 papers, inspection trips, symposiums, and panels

DURING 1955—75th Anniversary Year of The American Society of Mechanical Engineers—the attention of the membership was focused on the engineer and the world in which he lives. At five major meetings the engineer considered his contributions in the community and gave thought to his role in the world of communication, education, government, science, and finally, the Diamond Jubilee Year theme was climaxed by his evaluation of his part in commerce and industry, thus completing the cycle.

The ASME Annual Meeting, held in Chicago, Ill., Nov. 13–18, 1955, assembled some five-thousand engineers, their associates, and families at the Congress Hotel as headquarters, and the Conrad Hilton and Sheraton-Blackstone Hotels. Playing to "standing-room-only" audiences at the more than 110 technical sessions where more than 300 papers were presented and discussed, it was, on several occasions, necessary to accept the gracious offer of meeting rooms of the Western Society of Engineers for various committee meetings. Four of the Heat Transfer Sessions were held at Smith-Olsen Hall, Illinois Institute of Technology.

The American Rocket Society, an affiliate of ASME, celebrating its 25th anniversary in 1955, held its sessions within the frame of the ASME meetings as has been its custom in past years.

Special events commemorating ASME's 75th Anniversary Year were included in the extensive program. An "Early Bird Party" was tendered on Sunday afternoon, November 10, by the Chicago Section, host for the Meeting, in the Glass Hat Room of the Congress Hotel, for the hundreds of engineers who arrived early in Chicago to attend the Conference of the Council, Divisions, Boards, and

Materials-Failure sessions drew large audiences. Reports covered investigations of turbine-wheel and generator-rotor fractures, a large steam-turbine spindle failure, materials for large turbine and generator rotors, ultrasonic inspection of large rotor forgings, and work on brittle failure.

Authors' Daily Breakfasts had average attendance of 150 authors. These sessions are larger in size than the entire membership of ASME in the year of its founding in 1880. At these breakfast meetings, last-minute instructions are given to authors, session chairmen, and vice-chairman, by members of the Meetings Committee before sessions get under way. Gatherings such as these have done much to insure smooth operation of the technical sessions which form the nucelus of ASME meetings.

Committees. The host Section arranged an interesting and diversified program of entertainment and hospitality. The opening-day program was completed with a dinner and ice show in the Boulevard Room of the Hilton.

The President's Luncheon, held in the Gold Room of the Congress, officially launched the meeting and, while following the pattern of previous Society meetings which included a tea dance, luncheons, dinners, authors' breakfasts, and college reunions, this year's program offered a number of special events such as the Diamond Jubilee Dinner and Cavalcade. This lighthearted cavalcade paralleled engineering and entertainment over the past 75 years and featured the narration and caricatures of Roger Price, television star, a galaxy of star performers, and the music of an outstanding orchestra. The orchestra set the mood of the evening by playing many college songs.

The Towne Lecture was delivered on Wednesday by Col. Crosby Field, Fellow ASME, who spoke on "The Greatest Achievement of the Engineer in Commerce and Industry." Joseph W. Barker, ASME President, presided. Following the lecture there was a showing of the ASME motion picture, "To Enrich Mankind," which was designed to explain to the general public the importance and meaning of the role of mechanical engineering in our economy. The film has wide appeal and should prove of special interest to young men and women about to choose a career.

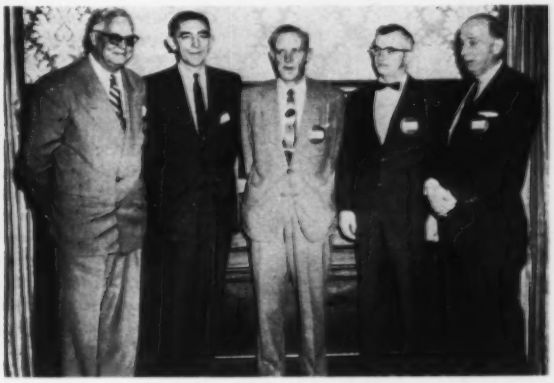
Thursday, November 17, was devoted to the celebration of the ASME's 75th Anniversary. The day opened with the Convocation, the reading of greetings from professional societies and industrial groups, and the first panel session on "The Economic Aspects of Technology."

At the Joint Honors Luncheon, which followed, five major joint engineering awards were presented. In the afternoon the second session panel, discussing the "Engineer in the World of Commerce and Industry," was held. The high point of the Annual Meeting was the Diamond Jubilee Annual Banquet, preceded by a social hour at which the Chicago Section acted as host. The President's reception after the banquet afforded the members an

Three ASME lecturers review the Annual Meeting program. ***Left to right*** **are: Louis C. McCabe, U. S. Public Health Service; Prof. R. T. Knapp, California Institute of Technology; and Prof. P. Frank Martinuzzi, Stevens Institute of Technology.**

Joseph W. Barker, ***right,*** **newly elected President of ASME, is shown receiving congratulations from outgoing-President David W. R. Morgan, during Annual Banquet. Mr. Barker is president and chairman of The Research Corporation.**

High lights of Geneva Conference on Peaceful Uses of Atomic Energy, August, 1955, were reported by panel of experts. ***Left to right:*** **W. H. Zinn, Argonne National Laboratory; H. A. Wagner, Detroit Edison; A. M. Weinberg, Oak Ridge National Laboratory; B. R. Prentice, General Electric; Philip Sporn, American Gas & Electric; and Moderator Oliver Townsend, Atomic Industrial Forum, Inc.**



Four vice-presidents and a director of the ASME, who retired this year from the Council, are shown prior to the President's Luncheon. ***Left to right*** **are: Thompson Chandler, Union Carbide & Carbon Company; Jess H. Davis, Stevens Institute of Technology; Vernon A. Peterson, Elliott Company; William G. McLean, Lafayette College; and Willis F. Thompson, Westcott & Mapes, Inc.**

opportunity to greet the new officers of the Society and many of the distinguished guests.

A well-organized and entertaining program of social events and sight-seeing trips was arranged for the women who attended the meeting.

Inspection trips were arranged to include visits to the R. R. Donnelly and Sons Company plant, the Ridgeland Generating Station of the Commonwealth Edison Company, and the Museum of Science and Industry.

Sidelighting the 75th Anniversary celebration was the exposition of Power and Mechanical Engineering, held at the Chicago Coliseum from November 14–18. Under the auspices of ASME, the exposition featured displays showing the newest developments in equipment, power generation and distribution, automatic control, mechanical-power transmission and utilization . . . maintenance as well as production equipment designed to lower operating costs and reduce maintenance. A new and timely section on Atomic Power also was featured.

America's largest portable engineering library set up shop in the Congress Hotel. The hundreds of engineers, businessmen, contractors, and technical educators who flocked to the library were interested in one or more of the 225 technical books, periodicals, bibliographies, reference works, safety codes, standards, power-test codes, and miscellaneous pamphlets offered for sale by ASME at prices ranging from 50 cents to $25.

Diamond Jubilee Day

The parade of technical and social events which characterize the Annual Meeting gave pause for Diamond Jubilee Day. The banner day was dedicated to the celebration of the 75th Anniversary of the Society.

James D. Cunningham, past-president and Fellow ASME, acted as chairman of the Convocation which opened the all-day program, held in the Conrad Hilton Hotel. During the ceremonies 32 professional societies and industrial groups engaged in the area of commerce and industry presented greetings to the ASME.

The professional societies greeting ASME were: The American Institute of Architects, American Documentation Institute, American Institute of Consulting Engineers, American Management Association, American Society of Training Directors, Association of Consulting Management Engineers, Inc., Controllers Institute of America, Industrial Management Society, Industrial Research Institute, Inc., and Society for Advancement of Management, and had as their spokesman John N. Richards, vice-president, The American Institute of Architects.

Lieut. Gen. James H. Doolittle, famous American aviation figure, is shown addressing 75th Anniversary Panel. General Doolittle reported on aviation achievements and prospects. At the Joint Honors Luncheon he accepted the Guggenheim Medal for Theodore von Karman.

Greetings from the following industrial groups were received: Air Conditioning and Refrigeration Institute, The American Boiler Manufacturers Association and Affiliated Industries, American Bureau of Shipping, American Gas Association, American Iron and Steel Institute, Association of Edison Illuminating Companies, Automobile Manufacturers Association, Chamber of Commerce of the United States of America, Diesel Engine Manufacturers Association, Edison Electric Institute, Gas Appliance Manufacturers Association, Inc., The Institute of Boiler and Radiator Manufacturers, Manufacturers Standardization Society, Manufacturing Chemists' Association, Inc., National Association of Manufacturers, National Coal Association, National Machine Tool Builders' Association, National Planning Association, Scientific Apparatus Makers Association, Steel Boiler Institute, Inc., Steel Plate Fabricators Association, and The Valve Manufacturers Association, with Charles M. Parker, assistant vice-president, American Iron & Steel Institute, as spokesman for this group.

Bearing on the theme of the Anniversary Celebration, "The Engineer and Our World," which was carried out in four national meetings previously held during the year, was the presentation of the first of two panels scheduled for Diamond Jubilee Day.

Economic Aspects of Technology

The first panel, "The Economic Aspects of Technology," sought to answer such questions as: What effect have technological advances in various fields had on the economy of the country? What can we expect in the future? What has been the influence of the professional engineering societies?

The speakers were Joseph B. Armitage, Hon. Mem. ASME, vice-president, Kearney & Trecker Corporation, Milwaukee, Wis.; Lieut. Gen. James H. Doolittle, Hon. Mem. ASME, vice-president, Shell Oil Company, New York, N. Y.; Samuel B. Earle, Hon. Mem. ASME, dean emeritus, School of Engineering, Clemson Agricultural College; Simes T. Hoyt, Hon. Mem. ASME, staff consultant, Castle & Cooke, Ltd., Honolulu, T. H.; Carl G. A. Rosen, Hon. Mem. ASME, consulting engineer, Caterpillar Tractor Company, Peoria, Ill.; and Clyde E. Williams, Hon. Mem. ASME, director, Battelle Memorial Institute, Columbus, Ohio.

Moderator for this panel was James D. Cunningham, president, Republic Flow Meters Company, Chicago, Ill., who also served as chairman, Executive Committee, Diamond Jubilee Annual Meeting Committees.

"Alike as two peas in a pod" isn't good enough any more, according to Joseph B. Armitage. The leader in design of precision machine tools and pioneer in automation said that there is a definite correlation between our standard of living and our ability to achieve finer and finer measurements in machine-tool work.

"We are told," he said, "that Wilkinson bored a cylinder on his boring machine that fitted the piston of Watt's steam engine so closely that a worn shilling could not be inserted between the piston and the bore."

This meant that commercial accuracy for the production of machine tools 150 years ago was probably 30 or 40 thousandths of an inch, he explained. Steel scales and bow calipers led to scale measurements of hundredths of an inch in the later years of the nineteenth century. At the turn of the present century micrometers and vernier calipers permitted machinists to think in terms of one-hundred thousandths of an inch.

Mr. Armitage concluded: "We speak of things being alike as two peas in a pod, but as far as accuracy goes we have passed that period many, many years ago. Not

Walker L. Cisler, *center,* receives Henry Laurence Gantt Gold Medal. L. C. Morrow, *right,* makes the presentation. Looking on is James F. Oates, who participated in the presentation ceremony.

Charles F. Kettering, *left,* is shown receiving the Hoover Medal at the Joint Honors Luncheon. Making the presentation is Scott Turner, who is chairman of the Hoover Medal Board of Award.

just two, but all the balls in a commercial ball bearing are the same size within 0.0001 in. and in precision ball bearing they are within one-hundred thousandth of an inch. But luckily we machine-tool men are not satisfied with these bearings; we are continually asking to have them made to closer tolerances and as they become ever better and finer the standard of living and the economy will become better and richer."

"The destructive power of our air force has been increased more than a million times," said Lieutenant General James H. Doolittle. The hero of World War II, who led America's first aerial strike from the USS *Hornet* to attack the Japanese mainland, the "Shangri-La" raid for 30 seconds over Tokyo, April 18, 1942, said: "The most dramatic effect of technology in military aviation is the stupendous increase in destructive power that has accompanied the development of our air-atomic arm. With the fission-type atomic bomb, the destructive power of our striking force was multiplied more than a thousandfold. With the fusion-type (hydrogen) bomb, the power went up over a millionfold."

In his appraisal of this era, he said, "There has also been great improvement in aircraft performance—in range, speed, and altitude. The Wright brothers' first flight covered 120 ft. Modern military planes have a range of over 10,000 miles. Speed and altitude have increased greatly. In World War II we used to think in terms of 300 mph and a service ceiling of 25,000 ft. Now 600 mph and 45,000 ft are common. We can confidently look forward to speeds of 1000 mph and altitudes of 60,000 ft. In this connection we might note that the X-1-A research plane has attained a speed of over 1650 mph and an altitude of more than 90,000 ft.

"There has been no leveling off in the curve of improvement in military aircraft performance. When it seemed that speed would be checked by the limitations of the piston engine, the jet continued the advance. Rocket power will carry the progress still further as aviation moves out beyond the atmosphere. As for range, with the advent of nuclear fuel, it will be virtually unlimited."

In conclusion, he said, "Commercial aviation traditionally follows the lead of the military. Thus, as military planes begin to face the thermal barrier—where the materials people have some difficult problems to solve—the commercial planes are approaching the so-called sound barrier, getting up toward 600 mph. They are also improving steadily in safety, in reliability, and in comfort."

Samuel B. Earle's discussion dwelt on influences of professional societies. He recalled that when he began his career as a teacher in agricultural South Carolina there was one member of ASME and no more than two or three-hundred engineers in the entire state. These numbers quickly changed with the State taking on a more industrial complexion with the coming of textile plants. He paid tribute to the professional societies and a special salute to ASME for the more recent work on nuclear energy and its now classic contributions through the Boiler Code and Screw Thread committees. He added that the Society's fine record as an individual society was enhanced by its work with Engineers' Council for Professional Development and Engineers Joint Council in the pursuit of more and better engineers and engineering.

Simes T. Hoyt, drawing on more than 40 years of experience in Hawaii's two leading industries—sugar and pineapples, told of the improvements and wealth both industries realized through engineering. Although he was modest about his own contributions, it is safe to say that his work from the earliest importation of the harvester to the present employment of automation equipment did much to influence the improvements. He told of the improvement which resulted in new cane, new machinery that necessity brought about, and the steps from hoeing to weed control. He is credited with the development of equipment bringing about appreciable savings in sugar. He supervised the installation of roads and water-power systems on the island of Lanai for the pineapple industry. There automation brought more prosperity and more jobs. He conducted the first experiments that showed conclusively the rapid deterioration of canned pineapple at temperatures above 100 F. Today, in Hawaii, automation equipment is employed in as many steps as possible, from the pineapple plant to the completed product and from the sugar cane to the handling of the end product, as it is known, and more are continually being developed.

Carl G. A. Rosen, for several years director of research at Caterpillar Tractor Company, author of numerous papers on diesel-engine combustion design, fuels and lubricants, and holder of many patents pertaining to this work, discussed automation. Citing Beecher's statement, "A tool is the extension of a man's hand," he developed his ideas on automation, holding automation fears were groundless, and concluded by saying it is just a new word for an old concept.

Philip Sporn, *center*, is congratulated on receiving the John Fritz Medal by T. G. Le Clair, *right*. Glenn B. Warren, *left*, who assisted in the presentation, looks on.

Elmer A. Sperry Award is presented to William F. Gibbs, *right*, by Robert B. Lea, *center*. Looking on is Elmer A. Sperry, Jr., who participated in the award ceremony.

Clyde E. Williams, head of one of the nation's largest research organizations, predicted an end to depressions in America. "No doubt," he said, "we shall always have ups and downs in the business cycle, and sometimes we may have recessions that hurt. But in our new, revolutionized, technology-based economy, I believe that depressions such as we have known in the past will never occur again." He also predicted that stock-market prices will eventually reach more than double their present level.

"I believe that the Dow-Jones industrial averages will make the 500 mark—and some of you may even see it cross 1000." The averages referred to are based on the prices of 30 representative industrial stocks. The Dow-Jones industrial average at the close of business on Tuesday, November 15, 1955, stood at 47.07.

Dr. Williams gave applied research much of the credit for the increase in American national productivity in a number of spheres—the synthetic plastics industry, whose output is now 11-12 times what it was 15 years ago; the electronics industry, whose sales have multiplied nearly 18 times since 1940; the aluminum industry, whose production is now 8½ times that of 1940; and the electric-power industry, which is growing at the rate of about 10 per cent per year.

He concluded, "We could, by presenting great masses of statistics, show a correlation between the increase in applied research and the increase in national productivity. It is obvious that research has become not only a dominant economic factor, but the very mainstay of our economy—the substance upon which our capitalistic enterprise feeds."

Joint Honors Luncheon

One of the most impressive occasions of the day was the Joint Honors Luncheon. This was the event when five of the most important honors in the engineering profession were awarded not by the ASME alone, but by the Society and the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Institute of Electrical Engineers, the Society of Naval Architects and Marine Engineers, Society of Automotive Engineers, American Management Association, and Institute of the Aeronautical Sciences.

Thorndike Saville, president of Engineers Joint Council and dean of engineering at New York University, acted as toastmaster. However, before Dean Saville assumed his duties on this auspicious occasion he was presented a special 75th Anniversary Medal of The American Society of Mechanical Engineers. Dean Saville was chosen for the award "in appreciation of his friendly co-operation and in recognition of his outstanding leadership in the Engineers Joint Council as its president." The special medal had been presented on previous occasions during the Anniversary Year to Colonel L. F. Grant, president of the Engineers' Council for Professional Development, and Harold S. Osborne, president of the International Electrochemical Commission.

The Elmer A. Sperry Award, established in 1955 and sponsored by ASME, AIEE, SNAME, and SAE, was presented to William Francis Gibbs "for invaluable contributions to transportation by sea, including the design of the SS *United States*." Presentation was made by R. B. Lea, chairman of the Elmer A. Sperry Board of Award, and Elmer A. Sperry, Jr., vice-president, Sperry Products, Inc., Danbury, Conn.

The Henry Laurence Gantt Gold Medal, established in 1929 and sponsored by ASME and AMA, was awarded to Walker L. Cisler "in recognition of his many constructive and inspirational contributions to national, civil, and military affairs, to international economic matters, to corporate management, to education, and to the development of leadership in the individual." Presentation was made by L. C. Morrow, chairman, Gantt Medal Board of Award, and James F. Oates, chairman of the board, Peoples Gas, Light, and Coke Company, Chicago, Ill.

The Hoover Medal, established in 1929 and sponsored by ASCE, AIME, ASME, and AIEE, was presented to Charles F. Kettering, "scientist, engineer, inventor, philosopher, organizer of scientific efforts, developer of engineering devices and techniques, leader in industrial research, whose ideals and accomplishments have been inspirations to the men of many countries." Scott Turner, chairman of the Hoover Medal Board of Award, made this presentation.

The Daniel Guggenheim Medal, established in 1928 and sponsored by ASME, SAE, and IAS, was awarded to Theodore von Karman "for long continued leadership in the development of aerodynamic theory and in its application to the practical problems of flight, in education in the aeronautical sciences, and in stimulating international co-operation in aeronautical research." The announcement of the award was made by Lieut. Gen. James J. Doolittle, USA (ret.) and member Daniel Guggenheim Medal Board of Award. General Doolittle accepted the Medal on Dr. von

Karman's behalf, as duties in Paris, as chairman of the Advisory Group for Aeronautical Research and Development of the North Atlantic Treaty Organization, made it impossible for Dr. von Karman to be present to accept it himself.

The John Fritz Medal, established in 1902 and sponsored by ASCE, AIME, ASME, and AIEE, went to Philip Sporn, "distinguished engineer, pioneer in utility-engineering practice, eminent executive, humane administrator." The presentation was made by Titus G. LeClair, chairman, The John Fritz Medal Board of Award, and Glenn B. Warren, vice-president, General Electric Company, Schenectady, N. Y.

Engineer and World of Commerce and Industry

The second of the Diamond Jubilee Day panels was devoted to "The Engineer and the World of Commerce and Industry." The four recipients of the joint-engineering honors discussed topics based on their respective fields of experience in keeping with the theme.

Alex D. Bailey, past-president and Hon. Mem. ASME, was chairman at this panel. The speakers were: Walker L. Cisler, Fellow ASME, president and director, The Detroit Edison Company, Detroit, Mich.; Charles F. Kettering, Fellow ASME, vice-president, director and general manager, Research Laboratories Division, General Motors Corporation, Detroit, Mich.; Philip Sporn, Hon. Mem. ASME, president, American Gas & Electric Service Corporation, New York, N. Y.; and William Francis Gibbs, Fellow ASME, president, Gibbs & Cox, Inc., New York, N. Y.

Opening the discussion, Walker L. Cisler said that atomic energy can provide heat resources 23 times the resources of the earth's supply of coal, petroleum, and other fossil fuels.

"Every day," said Mr. Cisler, "each person requires that more energy be expended on his behalf. Many things affect this; for instance, when one of us takes a plane—perhaps we go from New York to Los Angeles—we use up a part of the available energy of the world. Everything is taking much more energy than was ever used before."

He described atomic generating plants which have so far been designed and built as "monuments to our scientific and engineering know-how," but added: "However, these plants are pilot plants and much work still must be done to transfer the model created by the engineer into an economically feasible source of energy."

Charles F. Kettering, in his own inimitable way, pulled the props away from professional stuffiness. His lesson in humility will long be remembered by those who heard him describe the two kinds of engineers, the desk kind and the bench variety. He said he was the bench variety working with screw driver and pliers. Engineers working in research are working against fear and surprise. . .they are interested in services and things. The time factor in invention—the incubation period of ideas—is not fully understood. In conclusion, he said he'd give a medal to the great engineering profession for its unselfish work in trying to develop the human race, entirely independent of the egotism of its leaders.

Philip Sporn, one of America's top-ranking utilities executives, warned his colleagues not to place all their reliance on nuclear energy.

"A careful forecast of population indices of industrial production, and productivity for 1965 and 1975," he said, "shows that we will require over a thousand-billion kilowatthours of electric power by 1965 and two-thousand billion by 1975. For comparison, in 1955 we will use slightly above 500 billion. Few responsible experts would suggest that nuclear power can be developed fast enough to meet the bulk of our needs in this period as economically as more conventional means of supply. Considering the large amount of research and development remaining before atomic-power plants can be economically competitive realities, only a small fraction of the 100 million or so kilowatts of new generating capacity that will have to be brought into being in the next ten years can be nuclear."

Mr. Sporn said that, disregarding the possible contributions of atomic power, indications are that America will need over 200-million tons of coal for 1965 and over 500 million for 1975, as against the approximately 115-million tons that will be consumed by utilities in 1955.

Of the engineer he said, "The role of the engineer in society has never undergone the critical evaluation that it is now being subjected to. That the engineer's work has played a vital part in bringing about the world of today and in advancing standards of human welfare is plain enough.

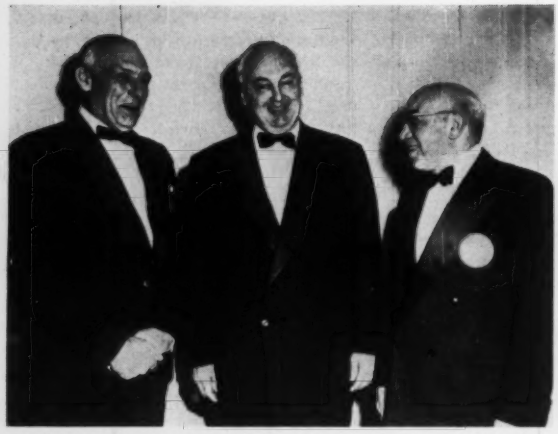
"In general, the engineer seeks to understand the findings of the scientist and give them practical application," he said. As an example he pointed to our current problems in perfecting atomic power. "It is here that the engineer's responsibility in modulating the technological developments based upon new scientific discoveries becomes important. We must look to him to protect us from the illusion that atomic power can successfully solve our own energy problem of the immediate future, even while we are seeking to perfect the new technology that will gradually enable atomic energy to assist in solving a longer-range energy problem."

William Francis Gibbs, by way of explaining why in most newspaper accounts reference is made to his sad mien. . .or that he looks as though he does not get enough to eat—told what it means to build a monarch of the sea lanes like the SS *United States*.

Enthusiasm and imagination were necessary ingredients. The problems of designing a ship like the *United States* are simple, and just three in number: (1) Take the factors of a cantilever bridge, (2) place a power plant underneath and a 3000-room luxury hotel above, and (3) launch it. While the simple problems are being ironed out the designer will be engaged in negotiation with a few agencies, among which are: U. S. Navy, Maritime Administration, U. S. Coast Guard, U. S. Public Health Service, American Bureau of Shipping, AIEE, Panama Canal Authority, British Factory Act, labor unions (several—these are the enlightened unions—they helped and did not hinder), owner (or owners), and last but by no means least the shipyard. Once the ship is launched it takes 1041 men to operate her. Since the *United States* was launched on July 3, 1952, she has made 76 round-trip voyages, or some 485,000 miles with a lifetime average of 30.65 knots. During these years of operating the *United States* "not once have the mighty vessel's shafts been stopped or slowed at sea because of any machinery difficulties." The SS *United States* is a tribute to the American system. He quoted from St. Luke, chapter 14, verse 11, "For whosoever exalteth himself shall be abased and he that humbleth himself shall be exalted." Each is a small person dependent on many people . . .helpful to morale and success.

Annual Banquet

With retiring ASME President D. W. R. Morgan, acting as toastmaster the Annual Banquet program continued the Diamond Jubilee theme. More than 1100 ASME members, their wives, and guests filled the Grand Ballroom of the Conrad Hilton Hotel on Thursday evening to witness the traditional presentation of honors and awards and the conferring of Honorary Membership on eminent and distinguished engineers.



Leading figures at Diamond Jubilee Banquet include *right*, David W. R. Morgan, outgoing ASME President; Roy T. Hurley, *center*, chairman and president of Curtiss-Wright Corporation, who delivered the Banquet address, and ASME's new President, Joseph W. Barker, *left*

Honorary membership in the ASME, the highest honor conferred by the Society, was awarded to seven leaders in engineering and scientific fields. Three of those honored include *left to right*, James H. Doolittle, Carl G. A. Rosen, and Samuel B. Earle.

Prof. Maurice S. Gjesdahl, *center*, of Pennsylvania State University, presents awards to Robert C. Dean, Jr., *left*, and Sylman Cromer. Mr. Dean won the Pi Tau Sigma Gold Medal Award. Mr. Cromer won the Richards Memorial Award.

Four of the seven leaders in engineering raised to the rank of Honorary Member of ASME are, *left to right*, Simes T. Hoyt Joseph B. Armitage, Clyde E. Williams, and Philip Sporn Fewer than 180 members have been elevated to this honor.

Following the Invocation by Carl J. Eckhardt, Fellow ASME, of the University of Texas, Dr. Morgan presented C. E. Davies, secretary of ASME, who read a telegram from Arthur L. Williston expressing his regrets for missing this year's annual banquet. Mr. Williston had attended 58 consecutive annual dinners.

Dr. Morgan then introduced the following past-presidents who were present: Andrey A. Potter, 1933; William L. Batt, 1936; William A. Hanley, 1941; Harold V. Coes, 1943; Robert M. Gates, 1944; Alex D. Bailey, 1945; D. Robert Yarnall, 1946; Eugene W. O'Brien, 1947; E. G. Bailey, 1948; James M. Todd, 1949; James D. Cunningham, 1950; J. Calvin Brown, 1951; Frederick S. Blackall, jr., 1953; Lewis K. Sillcox, 1954.

Dr. Morgan then read a telegram to ASME in which President Eisenhower congratulated the members of the Society on their outstanding accomplishments and on the belief in progress which is characteristic of them. "I extend to all of you my warm best wishes for a successful meeting and celebration and for continued achievement through the decades ahead."

Next came the recognition of ASME's lone 75-year member—Henry Marx. Mr. Marx, who was unable to be present, was honored at a special luncheon on March 20, 1955, in Cincinnati, Ohio.

Fifty-year Members of ASME who were recognized at the dinner included Samuel Broadus Earle, W. Trinks, and Carl Clifford Wilcox. The following 50-year members were not present: Julius Alsberg, Norman Campbell Chambers, John N. Chester, G. Norwood Comly, Frank S. Cox, Allen S. Crocker, Samuel Bovard Dougherty, Edwin David Dreyfus, Samuel W. Dudley, Edward Vinton French, William B. Goentner, Walter Hamlin Kniskern, Thomas Al-

fred Marsh, Walter J. Maytham, Frederick Clouston Moore, Benjamin Stuart Murphy, Francis Benjamin Northrup, Harold Linder Pope, Redfield Procter, Louis Gilmore Robinson, Frederick Edward Town, Charles Huntington Turner, William Whipple.

Dr. Morgan also called on members of the Old Guard who were present to rise and be recognized.

The following incoming Council members were then introduced: Elmer O. Bergman, Charles E. Crede, Bryan T. McMinn, Frank W. Miller, Albert C. Pasini, Louis Polk, Joseph Pope, J. F. Downie Smith, Glenn B. Warren.

Next, Dr. Morgan presented Dr. Joseph W. Barker, ASME's incoming President, who accepted the honor by lauding the members of ASME. He said they make the Society and do the work. Their spirit, Dr. Barker said, will carry ASME forward to an even greater position of leadership.

Honors and Awards

The conferring of honors and awards was a high spot on the evening's program. The Pi Tau Sigma Gold Medal went to Robert Charles Dean, Jr., Assoc. Mem. ASME, "for outstanding achievement in mechanical engineering within ten years after graduation."

The Richards Memorial Award to Sylvan Cromer "for outstanding achievement in mechanical engineering within 20 to 25 years after graduation."

The Junior Award to Ferdinand Freudenstein, Assoc. Mem. ASME, for his paper "Approximate Synthesis of Four-Bar Linkages" presented at the ASME Fall Meeting, 1954.

The Prime Movers Committee Award to Fred W. Argue, Mem. ASME, Edward C. Duffy, Mem. ASME, Louis Elliott, Fellow ASME, Walter F. Friend, Mem. ASME, Gustaf A. Gaffert, Fellow ASME (posthumously), and Bernhardt G. A. Skrotzki, Mem. ASME, for their ASME Symposium on Design and Operation of Outdoor Power Plants, conducted at the ASME Annual Meeting, 1953.

The first Blackall Machine Tool and Gage Award to C. J. Oxford, Jr., Mem. ASME, and J. A. Cook for their paper "The Influence of Tap Drill Size and Length of Engagement Upon the Strength of Tapped Holes" presented at the ASME Annual Meeting, 1954.

The Melville Prize Medal to Robert T. Knapp, Mem. ASME, for his paper "Recent Investigations of the Mechanics of Cavitation and Cavitation Damage" presented at the ASME Annual Meeting, 1954.

J. A. Cook, *left*, and C. J. Oxford, Jr., *right*, share honors at the Diamond Jubilee Annual Meeting Banquet. They received the Blackall Machine Tool and Gage Award. F. S. Blackall, jr., *center*, is sponsor of the award and past-president of ASME.

Winner of the 1955 ASME Melville Prize Medal is Robert T. Knapp, *right*, professor at California Institute of Technology, Pasadena, Calif. Presenting the Medal is ASME President Joseph W. Barker, president, The Research Corporation, New York, N. Y.

Ferdinand Freudenstein, *left*, receives the ASME Junior Award. Mr. Freudenstein is junior development engineer in the Scientific Instruments Division of American Optical Company, Buffalo, N. Y. Dr. Joseph W. Barker, ASME President, congratulates recipient.

Left to right are: Walter F. Friend, Fred W. Argue, Louis Elliott, Edward C. Duffy, and Bernhardt G. A. Skrotzki, who were recipients of the Prime Movers Committee Award for their contributions to the ASME symposium on the design and operation of outdoor power plants.

Honorary Memberships in ASME were conferred upon the following: Joseph B. Armitage, Fellow ASME; James H. Doolittle, Mem. ASME; Samuel Broadus Earle, Fellow ASME; Simes Thurston Hoyt, Mem. ASME; Carl George Arthur Rosen, Fellow ASME; Philip Sporn, Fellow ASME; Clyde E. Williams, Mem. ASME.

Roy T. Hurley—Banquet Speaker

The main speaker at the banquet, Roy T. Hurley, chairman and president of Curtiss-Wright Corporation, Wood-Ridge, N. J., presented a production-man's idea of what the engineer must do in the next 10 years.

In his talk, Mr. Hurley emphasized, in particular, the subject of budgets, calling on engineers to exercise the cost-accountant's approach. He predicted that 1956 will be a prosperous year both here and in Europe with a gradual leveling off of production during 1957.

Dinners and Luncheons

Dr. Morgan Reports at President's Luncheon

At the President's Luncheon, held in the Gold Room of the Congress Hotel on Monday noon, Lewis K. Sillcox, past-president and Hon. Mem. of ASME, presiding, a telegram of congratulations and "best wishes for a successful meeting and celebration and for continued achievement through the decades ahead," signed by President Eisenhower, was received with applause.

The principal speaker was David W. R. Morgan, President of the Society, who presented the high lights of a five-point program for ASME. He listed the following objectives:

1 A qualified membership of at least 80,000 by 1980.

2 Intensified efforts to occupy and retain a position of leadership in an era of technological complexity, advancement, and radical changes.

3 Acceptance in the public mind as representatives of the best in professional engineering and moral standing.

4 Continuation of policy that will demand the respect of scientists and engineers throughout the world.

5 Establishment of a board or committee whose sole function will be to contemplate and anticipate changes in technology, to the end that the Society may have a forward-looking plan in creating new sections and divisions to fit the needs of the mechanical-engineering profession.

The complete text of President Morgan's address will be found on pages 4–6.

Prior to the delivery of Dr. Morgan's address, the persons sitting at the head table were introduced. They included: Mrs. William E. Karg, of Philadelphia, Pa., president of the Woman's Auxiliary to the ASME; Dr. Joseph W. Barker, President-Elect, ASME; five ASME vice-presidents whose terms of office expire with the 1955 Annual Meeting—Willis F. Thompson (Region I), William G. McClean (Region III), Thompson Chandler (Region V), and Vernon A. Peterson (Region VII); J. H. Davis, director, whose term also expires; and A. C. Pasini, director, who remains on the 1955-1956 Council but in the capacity of vice-president of Region V.

Applied Mechanics Luncheon

This year's Applied Mechanics Luncheon held in the Blackstone Hotel on Tuesday, was devoted primarily to an informal business meeting of the Division. N. J. Hoff, chairman of the Division, who presided, called on various members to report on items of interest to the Division.

Martin Goland, editor of *Applied Mechanics Reviews*, reported that the subscription rates for the *Reviews* have been increased. Price to reviewers is now $7.50 per year, $10 to ASME members, and $25 to all others. This is being done, Mr. Goland said, to attempt to increase income since the magazine is still in great financial difficulty. He felt, however, that the many rocky paths ahead will eventually be overcome.

Mr. Goland also pointed out that AMR is bigger and better than ever. More than 750 periodicals are now being reviewed plus numerous symposiums and books.

R. E. Peterson reported that the International Meeting on Fatigue is to be held in September, 1956, under sponsorship of The Institution of Mechanical Engineers. A review meeting is to be held during the 1956 ASME Annual Meeting in New York. Plans for the meeting are going well and all the invitations are out, he said.

The Divisions' papers situation was summed up by Prof. Milkos Hetenyi. He reported that during the year 107 papers were accepted, 80 were rejected, and 71 were still in the reviewing process.

In closing the meeting Dr. Hoff discussed the possibility of establishing an Applied Mechanics Award—a medal to honor Professor Timoshenko. The medal would be awarded to a person who has made a significant contribution to applied mechanics. Methods of financing the fund for the medal and its custody were discussed.

As part of the luncheon program, R. D. Mindlin, incoming chairman of the Division, presented a certificate of appreciation to Dr. Hoff, the retiring chairman, for his services to ASME and the Division.

Heat Transfer Luncheon

The Heat Transfer Division met for luncheon on Tuesday noon at the Blackstone Hotel. H. B. Nottage, chairman of the Division, presided. He called

View of Hydraulic Old Timers' Dinner held during Annual Meeting. This informal dinner is a stand-out affair affording members of the Hydraulics Division and their associates the opportunity to reminisce about their experiences in the hydraulics field.

attention to the fact that the Division was celebrating its twenty-third anniversary and had invited members of the Education,Committee to be present, and spoke briefly on the engineer in the world of free men.

Myron Tribus, who will serve as chairman during the coming year, paid tribute to Mr. Nottage who, he said, had reorganized the Division and set it to work. He then presented a certificate of award to the retiring chairman.

The luncheon speaker was O. A. Thornsjo, personnel manager, Aeronautical Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., who presented his personal views on the subject of engineers and unions.

Robert C. Dean, Jr., *right,* professor at M.I.T., main speaker at Members and Students Luncheon, congratulates two young engineers whose technical papers were awarded ASME prizes. Nino R. Addonzio, *left,* of Newark, N. J., was given the Undergraduate Student Award. Richard F. Slember, *center,* of Westinghouse Electric Corporation, Pittsburgh, Pa., received the Society's Charles T. Main Award.

Management Luncheon

An optimistic note was sounded by Glenn B. Warren, Fellow ASME, vice-president and general manager, Turbine Division, General Electric Co., Schenectady, N. Y., when he stated that executive opportunities for older men are on the increase.

Addressing the Management Luncheon audience on the subject, "Current Trends and Some Problems in Management," Mr. Warren stated further that the increasing growth and complexity of American business is leading to greater demand for more and better managers.

"Further," he added, "experience indicates that the vast majority of successful managers in business generally are mature men in their late forties and fifties, sometimes running into the sixties."

On the other hand, he pointed out: "A careful history of great technical contributions indicates that they are frequently originated and brought forth by younger men, averaging in fact, in their thirties. It is the exception to have outstanding contributions by a technical specialist in his mature years."

The trend to decentralization, Mr. Warren said, is in line with the trend in government all over the world, as displayed by the urge toward nationalism and local autonomy on the part of nations in the former great empires and colonial areas. He said:

"The great strength of the free-enterprise system as contrasted to the Communist system is based upon the composite strength and ingenuity of the individual managers of more than one-million businesses in this country who are making independent decisions directed and guided by the hard necessity of insuring their own economic survival."

Coauthor of Mr. Warren's talk was Harold F. Smiddy, Mem. ASME, vice-president of management consultation services of General Electric Company.

J. Keith Louden, Fellow ASME, vice-president and general manager, York Corporation, York, Pa., served as toastmaster.

L. E. Newman, retiring chairman of the Executive Committee of the Management Division, was presented with a Certificate in recognition of his leadership.

Diamond Jubilee Night

The Diamond Jubilee Dinner and Cavalcade presented Tuesday evening in the Grand Ballroom of the Conrad Hilton Hotel, was an innovation at an ASME Annual Meeting. The Cavalcade consisted of a lighthearted review and took the form of a salute from show business to ASME in particular, and engineering in general. Decade by decade ASME received its accolade from a galaxy of Broadway show personalities in song, dance, and drama.

Headed by television and radio star Roger Price, a master of droll monologues aided with his clever "Droodles" cartoons, the Cavalcade provided an evening of fun and entertainment for all who attended.

Members and Students Luncheon

The Members and Students Luncheon held during the Annual Meeting is an affair that many remember with pleasure and look forward to with enthusiasm—this year's luncheon was no exception. David W. R. Morgan, past-president of ASME, who acted as toastmaster opened the discussion with some remarks on the dignity of educators and the esteem with which industry regards them in Europe The profound impression that this respect for educators made on Dr. Morgan led him to suggest that it might be well if we in the United States would emulate this attitude.

After introducing the guests at the head table, Dr. Morgan presented the incoming President of ASME, J. W. Barker. Dr. Barker disclosed that ASME Student Members were not taking an active interest in ASME affairs after graduation and an appalling number were dropping out of the Society. As a matter of fact, more than 21,000 ASME Student Members were dropped from ASME rolls from 1949 to 1953. He stated he was going to devote a great deal of time to correct and possibly to eliminate this deplorable situation.

C. E. Davies made an important and extremely interesting announcement regarding the International Association for the Exchange of Students for Technical Experience (IAESTE). Organized in 1948 by nine countries in Western Europe to provide on-the-job training for advanced students of science and technology in countries other than their own; 21 countries, including the United States, were participating in the plan by 1955. Mr. Davies read the requirements for the students and related that while the plan has had token acceptance he hoped that that acceptance would receive wider recognition because the plan of the on-the-job program would be mutually beneficial to the students who came to the United States as well as to the Student who went abroad. (The entire announcement is published in the ASME News of this issue.)

Dr. Morgan then called on J. Stanley

Morehouse, dean of engineering, Villanova University, to present the recipients of awards. The Charles T. Main Award was presented to Richard J. Slember, Cooper Union School of Engineering 1955 and presently employed in the Atomic Equipment Division, Westinghouse Electric Corporation, Cheswick, Pa., for his paper, "The Atom and the Mechanical Engineer." Nino R. Addonizio, Newark College of Engineering 1957, received the Undergraduate Student Award for his paper "Analysis of Vibration Isolation for Vaneaxial Fans to Reduce Shipboard Noise."

"The pressure of scientific discovery during the past 20 years has fertilized the reawakening of engineering thought," said Robert C. Dean, Jr., assistant professor, mechanical-engineering department, the Massachusetts Institute of Technology. In his talk entitled "A Role for Student Professional and Honorary Societies in Engineering Education" he said that with the growing impact of technology on our society the engineer stands in a position of special responsibility. He must guide technical progress so that the whole community derives the greatest benefits.

"The engineer of the future, with significant responsibility," he stated, "will bend his efforts more and more toward problems which are broad in nature. The specialist will not fill the positions of leadership, because optimum solutions of engineering problems will increasingly span all of the traditional disciplines, mechanics, materials, thermodynamics, electricity, atomic physics, economics, and human relations. Today, we see increasing trends, in our more progressive industries, toward such engineering."

Speaking of engineering education, he said, to produce engineers, not scientists, increased attention in the education must be given to the uses of fundamental knowledge to development of the attitudes most likely to lead to progress. This pattern of education demands a great deal more from the student than was asked of him in the past. "A man has never been mentally developed or matured by others," he declared.

He added further that in engineering schools, the student professional and honorary societies are often the only and usually the best means for student expression and action. Mr. Dean then went on to tell of his own experiences as a student and as a member of the M.I.T. faculty.

Railroad Luncheon

Fred G. Gurley, president of the Santa Fe Lines, was the principal speaker at a Railroad Luncheon sponsored by the Railway Supply Group of Chicago on Wednesday, in the Conrad Hilton Hotel. Members and guests of the ASME Railroad Division, as well as the General Committee and the Car Construction Committee of the Mechanical Division of the Association of American Railroads, were special guests.

H. W. Faus, consulting engineer (retired, New York Central System), and T. C. Gray, vice-president of Pullman-Standard Car Manufacturing Company, Chicago, were promoted to Fellow ASME for their outstanding contributions to the Society. C. K. Steins, who presided, retiring chairman of the Railroad Division, was presented with a certificate in testimony of the high regard of his co-workers and the deep appreciation of the Society for his valued services in advancing the engineering profession.

Consulting Engineers' Luncheon

An invitation was extended by J. S. Tritton to America's consulting engineers to join the International Federation of Consulting Engineers (FIDIC). Mr. Tritton, who is chairman of the British Association of Consulting Engineers and president of FIDIC, appeared on the Consulting Engineers' Luncheon program on Wednesday in the Congress Hotel.

FIDIC, Mr. Tritton pointed out, was founded in 1913 by a group of consulting engineers:

1 To establish and maintain an international body of competent honorable and independent experts.

2 To establish a bond of union and promote friendly and useful relations between qualified consulting engineers.

3 To generalize the application and observance of such rules of conduct as should guide the true consulting engineer in the execution of his profession or mission.

4 To work for the development of his activities and watch over the maintenance of his reputation and dignity.

FIDIC now comprises member associations in ten countries, representing some 3000 individual consulting engineers, and is registered as an international body domiciled in Zurich, Switzerland.

One of FIDIC's current tasks, according to Mr. Tritton, is the preparation, in collaboration with the International Federation of Civil Engineering Contractors, of a set of international conditions of contract. These conditions, when agreed, will go far to put international tenders for major public works on a fair and comparable basis. International competition is a healthy stimulant, but in these troublous times the consulting engineer has a special responsibility in seeing that prices are fair, bargains are kept, just claims are met, and the uninitiated are not exploited to their disadvantage. He can do much to avoid those sources of friction which, if allowed to accumulate, can form focal points of tension and build up obstacles in the path of peace.

J. T. Rettaliata, Mem. ASME, president, Illinois Institute of Technology, Chicago, Ill., the principal speaker at the luncheon, discussed the financial dilemma of private educational institutions, in particular the technical schools.

In general, he said, the major source of income to private colleges and universities is student fees, and many of these institutions are operating at less than optimum enrollments. A principal reason for this is the student trek to the tax-supported institutions because of the tuition differential. Another cause of financial distress is dwindling endowment income. And, of course, the private colleges and universities have suffered from inflation.

Obtaining additional income through contributions appears to be the most feasible method for solving the grave problem that exists. The sources of such contributions resolve into the categories of alumni, foundation, individual, and corporate support. Since, under our present tax structure, the wealthy individual is rapidly becoming extinct, the colleges and universities must rely principally on the remaining three sources. Of these, corporate support possesses the greatest potential.

In America, where under our free-enterprise system industry has flourished and achieved great stature, he said, it is probably natural to turn to this source of strength when in need. The colleges feel that they have played a role in industry's good fortune, and, consequently, do not consider it inappropriate to approach industry for support in a period when their future is in jeopardy. It is reasoned that better business can continue to be built only if higher education remains strong.

Harry R. Westcott, Fellow ASME, president, Westcott & Mapes, Inc., New Haven, Conn., presided at the luncheon.

Towne Lecture

The greatest achievement of the engineer in commerce and industry was his substitution of mechanical power for the muscles of slaves, according to Crosby Field, Fellow ASME, and president of Flakice Corporation, Brooklyn, N. Y. Mr. Field, who gave the Towne Lecture on Wednesday afternoon, described today's eastern world as the "pre-engineer

Crosby Field, Fellow ASME, who delivered the Towne Lecture. His subject was "The Great Achievement of the Engineer in Commerce and Industry."

world," comparable to the western world of 150 years ago. The cost of power, he said, has been reduced to a point below that of the cheapest slave. In our engineer world, and only in our engineer world, slavery is uneconomical and, therefore, has ceased to exist.

As an example of how "the engineer removes the need for slavery," Mr. Field cited the elimination of galley slavery, which existed until the middle of the nineteenth century, when steam power made it unprofitable.

He recited a history of slavery, beginning with the time of Hammurabi, about 2300 B. C., and pointed out that the price of human beings has varied, much in the manner of other commodities, according to the law of supply and demand.

During the dark ages in Britain, for example, the price of a man was the same as that of a hawk or a greyhound. An educated slave in Athens, during the time of Demosthenes, brought no more than a well-bred horse, while the average hack writer brought half again as much as a good laborer.

It is recorded that one man spent 300 coins for a dog at a time when singers brought five and schoolmasters only seventeen.

The ancients even imposed duties and taxes on the import and sale of human beings. Rome replaced a one-eighth import duty on eunuchs and one-fortieth on other slaves, with both being subject to an additional two to four per cent sales tax.

One factor remained fairly constant throughout history, according to Mr. Field:

"Except in relatively few instances, usually due to some quirk in the law, the price of a female, age for age and condition for condition, usually ran about half that of a male slave."

In the final analysis, Mr. Field concluded, the nations that have built their strength upon slavery have built upon a false foundation.

"The most hopeful fact history gives us," he said, "is that although slavery was the basis of all pre-engineer world civilizations, it was also the nemesis of each individual slave society."

The Towne Lecture was named for Henry Robinson Towne, who served as ASME president in 1889. Established to give "opportunity for an outstanding leader in the field of management, economics, or business to reveal his experience, preferably related to the scientific method in industry or business," the series was begun in 1925 with a talk by Herbert C. Hoover, then U. S. Secretary of Commerce.

Joseph W. Barker, incoming ASME President, presided.

ARS Honors Night Dinner

The instrumented satellites to be launched during the International Geophysical Year 1957-1958, have an official nickname now—"LPR", or Long Playing Rocket. This disclosure came during the major address before the 25th Anniversary Honors Night Dinner of the American Rocket Society on Wednesday, by Joseph K. Kaplan, chairman of the U. S. National Committee for IGY.

Dr. Kaplan also announced the appointment of ARS President Richard W. Porter—toastmaster for the evening—as chairman of the Committee's Earth Satellite technical panel.

Dr. Kaplan said that the U. S. "will fire hundreds of research vehicles, ranging from the relatively small balloon or aircraft-launched vehicles, through multiple-stage, solid-propellant combinations to high-performance Aerobees capable of reaching 200 miles." They will be launched from locations ranging from the arctic to the antarctic.

He said that about 10 LPR's would be fired, with the expectation that at least five would establish themselves in orbits, circling at 200 to 800-mile altitudes for about two weeks.

A high light on the evening's program was the presentation of the following awards:

Robert H. Goddard Memorial Award to Lt. Col. E. N. Hall, Western Development Division, Air Research & Development Command;

C. N. Hickman Award to F S. Miller, Aerojet-General Corporation;

G. Edward Pendray Award to Walter Dornberger, Bell Aircraft Corporation,

James H. Wyld Memorial Award to Lt. Col. John P. Stapp, Holloman Air Development Center;

ARS Astronautics Award to Wernher Von Braun, Redstone Arsenal;

ARS Student Award to Richard W. Foster, Purdue University.

Harry F. Guggenheim, *right,* receives Honorary Membership in the American Rocket Society. Richard W. Porter, ARS president, confers the honor at the society's 25th Anniversary Honors Night dinner. ARS, an affiliate of ASME, held its annual meeting within the frame of the ASME Diamond Jubilee Annual Meeting. Mr. Guggenheim is only the second person to be so honored by the society.

The following were elected as Fellow Members of ARS: Ali Bulent Camble, Northwestern University; Bernhardt L. Dorman, Aerojet-General Corporation; Robert H. Jewett, Boeing Airplane Company; Roy Healy, North American Aviation, Inc.; Rear Admiral J. H. Sides, Office, Chief of Naval Operations; E. G. Uhl, The Glenn L. Martin Company; and Paul Winternitz, New York University.

Nuclear Engineering Luncheon

Early fears that atomic-energy generation might prove to be a threat to the steel industry have been largely dispelled, according to Charles L. Huston, Jr., president of Lukens Steel Company, Coatesville, Pa. He spoke at a luncheon in the Congress Hotel on Friday, sponsored by ASME's recently formed Nuclear Engineering Division. He told the group that the industry had felt concern over the possibility that drastically different processes for converting atomic fuels into commercial power would reduce substantially on short notice the market for steel in the future, making contributing plant facilities idle and causing unforeseen unemployment.

"You can appreciate how natural was this concern," he said, "if you will bear in mind that over the years the manufacture of turbines, heat exchangers, high-pressure heat-transfer units, and other types of basic equipment for the production of electric power has been an important consuming market for steel, just to mention a specific market and a specific industry."

Another worry of the industry, he said, was over whether "the introduction and development of atomic energy will make revolutionary and abrupt changes in our industrial processes, rendering obsolete overnight countless millions of dollars in industrial equipment."

Both these worries, he concluded, are no longer valid. He said:

"We have learned that no hocus-pocus, but instead, ordinary processes produce power with atomic fuels. At the same time, it has become increasingly evident that steel in its various types and with its many characteristics and qualities has played, and will continue to play, an important role in the successful development of nuclear energy."

On the other hand, he said:

"We will be negligent and shortsighted if we do not bend every reasonable effort to adapt atomic energy as fully as possible to the public welfare."

B. R. Prentice, Mem. ASME, of General Electric Company, commented that ASME has used a cautious approach with regard to atomic energy. This, he said, was due to security and classification which would naturally hamper and limit any important disclosures. However, since Geneva the situation has changed There is now much design engineering available including atomic power-plant technology, he reported.

Mr. Prentice also emphasized that design, economy, etc., of power stations are traditionally ASME. And, he said, practically all phases of atomic power plants fit into the sphere of mechanical engineers. For example, the core itself, except for the nuclear physics, is mechanical.

Mr. Prentice concluded his remarks by urging the Nuclear Engineering Division to take full advantage of the available data and developments now occurring in the nuclear field. He called on the Division to develop a substantial program for the 1956 ASME Annual Meeting, with perhaps four or five sessions.

A. C. Pasini, retiring chairman of the Division, and T. A. Solbery, chairman for 1956, acted as toastmasters.

As part of the program, certificates of appreciation were awarded to A. C. Pasini and to Alex Bailey who sparked the Nuclear Energy Application Committee.

A. C. Pasini, *left,* outgoing chairman of the ASME Nuclear Engineering Division, turns over the gavel to the new Division chairman, Rear Admiral T. A. Solberg, *right,* U. S. Navy (ret.), who will preside over the group's activities during 1956. Looking on, at the Nuclear Engineering Luncheon in Hotel Congress, is Alex D. Bailey, *center,* past-president of ASME.

Early fears of the steel industry that atomic-energy generation might make abrupt changes in steel and industrial-equipment manufacture have been dispelled, said Charles L. Huston, president of Lukens Steel Company, Coatesville, Pa., to the Nuclear Engineering Luncheon audience

Technical-Program High Lights

This year's Annual Meeting technical program, consisting of some 260 papers plus numerous panels and symposiums, offered those in attendance a variety of subject matter—enough to whet the appetite of any inquisitive engineer's constant search for technical knowledge. Some of the high points from the extensive program follow:

Power. Full details on the results of the investigation of the failure of a low-pressure turbine spindle at Ridgeland

Station, Chicago, Ill., were released at a Materials Failure Symposium sponsored by the Power and Metals Engineering Divisions. The 165,000-kw cross-compound turbine spindle failed on Dec. 19, 1954, during a routine overspeed-trip test after four months of service at the Commonwealth Edison Company Station.

Essentially, the studies show that the accident was caused by flaws present in the forging at the time of manufacture, but which were not identified as flaws with inspection techniques in normal use when the forging was made in 1952.

The investigation covered every step that offered any promise of an answer to the burst, the first such spindle forging failure in Allis-Chalmers' history. Design of the spindle and turbine operating history were carefully studied. Design stress levels at all points in the spindle were found to be conservative and the operating procedures were found to be entirely in accord with good practice.

Each step in the production of the forging at the forging-manufacturer's plant was carefully studied, and no deviations from accepted pouring, forging, or heat-treating practices were found. The forging had been inspected by every recognized and accepted nondestructive procedure prior to acceptance. Ultrasonic indications were found by both the manufacturer's and Allis-Chalmers' inspectors. However, at that stage in the development of sonic testing, indications of the level measured were not considered a cause for rejection of the forging, since large forgings normally contain harmless discontinuities.

Thorough metallurgical investigation showed that a combination of hydrogen flakes and high notch sensitivity (susceptibility of brittle failure), occurring together in areas deep within the central mass of the forging, was the primary cause of the fracture. It is unlikely that either of these conditions occurring by itself could have resulted in a failure.

According to the paper, there are three likely areas where improvement in the metallurgy of large forgings can take place: Improvement of the forging material, improvement in forging-processing methods, and improvement in inspection techniques. The latter, it is felt, holds the most immediate promise of results.

Other papers in the two-part symposium reported on the turbine-wheel fracture at Tanners Creek; the fracture of a large generator rotor at Cromby Station of Philadelphia Electric, and of a second rotor originally intended for delivery to the Arizona Public Service Company; materials for large turbine and generator rotors—their manufacture and methods of testing to assure their reliability; the problem of establishing criteria, based on ultrasonic examination, for the acceptance or rejection of large rotor forgings; and the work of a Test Group on brittle failure of large steel forgings.

Design details of this country's first "supercritical" pressure steam boiler and turbine were presented at another Power session. This outstanding development in the electrical power-generation field is a project of the American Gas & Electric Service Corporation, and is being installed in the Philo Plant of the Ohio Power Company, a member of the American Gas system. The new unit's expected heat rate is 8500 Btu per kwhr.

The complete unit, boiler, turbine, and auxiliaries, were described in three papers.

The boiler, a radical departure from American design, is, in effect, a continuous run of tubing into which water is pumped at one end and out of which comes highly superheated steam at the other end. It is designed to furnish 675,000 lb of steam an hour at 4500 psi and 1150 F. Its estimated capability is 740,000 lb of steam an hour.

At a Joint Machine Design—Power session it was reported that the electric-power industry, which now ranks first in over-all investment in the United States, is expanding faster than the country's manufacturing industries as a whole. Present rate of growth will require generation capacity of an additional 600 watts per person by the end of another ten years, a total increase of 100 per cent, or 100 million kw.

Steam-electric generation from conventional fuels seems likely to be increasingly important in power generation despite development of nuclear-fuel-powered generating stations, it is anticipated. It now accounts for 75 per cent of all electric power generated. The remaining sources are hydroelectric plants which produce 23 per cent of the total, and internal-combustion engines with 2 per cent.

Nuclear energy for electric-power production is expected to be of major importance and will become a significant part of the total power capacity within 25 years, according to the paper.

Aviation. Air Freight—A Blueprint for 1965 was the subject of a joint Aviation Division-IAS—SAE-Materials Handling Division panel. During the session a threefold increase was predicted by 1965 in the volume of goods shipped by air.

Air freight, it was pointed out, has only begun to develop its markets. An era was envisaged in which the principle of the assembly line would be extended to the suppliers who bring parts to the factories and to the vendors who sell the finished product.

The audience was warned that air freight has been, is, and always will be a relatively expensive form of freight transportation. However, some effort must be made to reduce rates, but other considerations—expansion of capacity and improvement of performance—come first.

In addition to reduced rates, it was

Materials failures leading to power-plant breakdowns in several parts of the U. S. were discussed by *left to right,* seated, H. D. Emmert, Allis-Chalmers Manufacturing Company, and D. H. Winne, General Electric Company. Standing, *left to right,* are: A. W. Rankin, B. R. Seguin, E. L. Fogelman, and Carl Schabtach, all with General Electric Company.

urged that industry take the following steps in the next ten years:

1 Expansion of the air-freight network to include the entire continental United States, with regular overnight schedules between the 60-odd production and distribution centers and extension of service to thousands of smaller communities.

2 Use of interline cargo planes, similar to present use of interline passenger planes.

3 A vigorous sales effort to convince traffic managers that dependable speed can be converted into an over-all production or distribution economy.

4 Continuing air-carrier research into "the motives, the machinery, and the methods of industrial production and distribution."

5 Development of aircraft designed specifically for freight service, instead of combination passenger-cargo planes.

6 Improvement of freight-terminal facilities.

Production Engineering. An automatic foundry—one in which the raw materials come in at one end and finished castings go out the other—is now practically a reality, thanks to the development of the shell-molding process, it was reported at a joint Production Engineering—Materials Handling Session.

The shell-molding process represents to the foundry industry a step closer to the automatic or push-button foundry.

Shell molding eliminates the physical work involved in making a mold. Production is dependent upon the shell-molding machine cycle.

The handling of sand and resin to storage, as well as the proper mixing and delivery of the sand-resin mix to the shell-molding machine, can be completely automatic. It is possible, by mechanical equipment, to eliminate the machine operator and the labor involved in placing and removing the shell molds at the closing machine. These men, however, inspect the shells at the machine and the molds after closing, assuring satisfactory operation of the system.

According to another paper, predicting how soon and to what extent new workers become efficient on their jobs, and finding out what is the most economical way to adjust production to seasonal fluctuations, are only two of the new services that electronic computers are now performing in the field of production engineering.

A whole series of actual applications of electronic computers in production management was described during a Production Engineering—Metals Engineering session.

In the future electronic computers may even help management to be prepared for unexpected actions of competitors and for other unpredictable "natural" events.

Among the computer applications described in detail in the paper were production scheduling and control of shop orders; calculation of machine loads and raw-material needs; evaluation of the work standards in a job-shop fabrication unit; a solution of the problem of assembly-line balancing to reduce idle time at work stations; and determination of the most efficient inventory management, including means and methods of shipment.

The latest computers that do such work, the paper said, can make from 250,000 to more than 1,000,000 additions or subtractions per minute, or from 50,000 to 240,000 multiplications. They can make from 500,000 to more than 1,000,000 logical decisions a minute. They can read and write more than a million characters a minute. They can handle large numbers of variables simultaneously. They can enumerate a large set of possible actions and make allowance for a great number of variable phenomena.

Fuels. Crushed coal can be made to flow from a storage bin like a viscous fluid when air at low velocity is passed upward through the bed. Furthermore, the angle of repose is reduced from 50 to as low as 2 degrees with the horizontal, which means that flat-bottom bunkers can be emptied to a greater degree through an opening in the bottom or side.

Experimental studies on this method were presented at a Fuels—Gas Turbine Power Session.

According to the paper, the studies were initiated to find a convenient and practical way to transfer crushed coal from a locomotive tender to the coal pump feeding a coal-fired gas turbine used for motive power. Beyond its special application to the gas-turbine locomotive, further development of the process could be extremely valuable to utility and industrial plants where coal is the most economical fuel. Most of the previous studies of handling materials by this fluidization process have been confined to those in the pulverized state.

In general, this initial research indicates that by using aeration, the design of coal bunkers and storage bins can be drastically changed. Aerated coal does not require long hopper bottoms to insure complete clearance of the storage bin. Flat bottoms may be used with side discharge, and it may also be possible to pump the crushed coal in this state to the point of use.

Synthetic-lumber substitutes in increasing quantity were predicted as the answer to America's growing shortage of old-growth timber by Armin Elmendorf, president of Elmendorf Research, Inc., Chicago, Ill.

Eugene W. Jacobsen, chief design engineer, Gulf Research & Development Company, Pittsburgh, Pa., told attendees that the petroleum industry will depend heavily upon mechanical-engineering advancements for progress

Gas-Turbine Power. Experimental operation of a coal-burning, exhaust-heated gas turbine has proved that the exhaust-heated cycle is feasible. The two-year test has also proved that the equipment is rugged, and capable of operating even when there is considerable maladjustment and deterioration of components.

These conclusions were based on tests made at McGill University in a program supported by the Canadian Department of Mines with the help of Dominion Coal and Steel Corporation, Montreal.

It was added, however, that before such operation could be said to be practical commercially, there are other problems to be solved. It is confidently expected that they will be solved during a new program of tests now under way, and it is hoped that at the conclusion of

Arnold E. W. Johnson, vice-president for engineering, International Harvester Company, Chicago, Ill., traced the development of farm equipment. He outlined features of the most recent and soon-to-be announced equipment.

The relationship of the consulting engineer to contractor and client was discussed by Fred W. Argue, vice-president and engineering manager of Stone & Webster Engineering Corporation, Boston, Mass.

Bryon W. Saunders, associate professor, College of Engineering, Cornell University, Ithaca, N. Y., called for new methods of accounting in the relating of materials-handling costs to over-all production cost

Charles H. Shields, Jr., chemical engineer with General Electric Company, Schenectady, N. Y., who outlined a process of filtration to remove trace metals from No. 6 oil before a Gas Turbine Power Session

Charles R. De Carlo, International Business Machines Corporation, New York, N. Y., discussed and analyzed the logical and mathematical abilities of electronic computers for solving problems of production management

F. H. Reynst, from Sevres, France, outlined work currently being done in the field of pulsating combustion, which was widely employed during World War II for propelling bombs and then discarded

this program sufficient progress will have been made to justify construction of an industrial power plant that will meet the requirements of successful commercial performance. Heater cost would be far from prohibitive in applications requiring relative small powers.

Features of the experimental power plant are combustion of coal in a furnace at essentially atmospheric pressure and the heating of compressed gas by transfer of heat from hot combustion products. Adaptation of existing technology to gas-turbine operation appeared easier than evolving a completely new technology.

The main problems have been the design of a suitable furnace and heater to transfer the heat liberated from coal to compressed air at 60–90 psia and temperatures of 1250–1350 F. The main objects of the experimental plant have been to provide for tests of the performance of the furnace and heat-exchanger system, and their interaction on the gas-turbine unit.

Wood Industries. An extrusion process for the manufacture of Chipcore, a wood-particle board, was described at a joint Wood Industries Division—Forest Products Research Society meeting.

The method makes possible automatic and efficient continuous production. One company, it was said, utilizes 85 per cent of wood-waste cuttings for furniture frames with a standard extrusion installation, turning out Chipcore for footstools at the rate of 10,000 ft per 24-hr day.

Among other articles adaptable for manufacture by the extrusion method are round forms for belting cores, tubes for flush doors, and strips with tongue and groove for flooring.

The following advantages were cited for the process: low labor cost; wide range of densities; chip orientation, with chip alignment generally perpendicular to the board surface, resulting in better bonding to veneer, better screw holding, and greater compression strength; smoother surface; uniform thickness, with equal distribution of particles; firm edges, eliminating the need for edge trimming; flexibility of dimensions; direct manufacture of molded or shaped product; low initial investment for a complete in-plant extruder installation; compact layout, resulting in savings in space needed for operation.

At another session it was predicted

that America's worsening shortage of old-growth timber may be offset by the use of increasing quantities of synthetic lumber.

Synthetic lumber was described as wood shaving board, because it is made of specially cut and resin-bonded shavings. Boards have the same strength properties in length and breadth directions, and do not shrink or expand noticeably with changing atmospheric conditions. Boards as large as 6 × 12 ft and $^3/_4$ in. thick are now being made. In Germany they are usually faced with veneer when used in furniture, but the natural finish is used for doors, interior paneling, and decorative purposes, with varnish or lacquer coatings. Some of this material is used for freight-car construction.

Some European factories make the boards in three plies, the outer plies being made of shavings and the interior of smaller chips or shavings, frequently with less resin. Fine waste, such as sawdust and planer shavings, are unsatisfactory except to a limited extent in the core of three-ply boards.

Railroads. American railroads retired 1000 more steam locomotives during the past year. During the same period they purchased or leased 871 diesel locomotives. Every major Class 1 railroad in the United States now operates or has on order some type of diesel-electric locomotive, to bring the total to 24,348, as against 7047 steam units.

These figures were cited in the annual railway progress report presented by the Railroad Division. The report said that although electric drive predominated, hydromechanical-drive developments continue among foreign manufacturers, with increased attention being shown by domestic firms.

Train "X," the new bidirectional, low-center-of-gravity, roll-compensating, lightweight design for the New York Central and New York, New Haven & Hartford railroads, introduces an amazing change in the picture of American railroading. Characteristic features of the new-type train are (1) outstanding passenger comfort and appeal, (2) greatly reduced initial cost, and (3) important savings in operation and maintenance.

The train's trailing weight is only about one third that of a conventional passenger train, yet spaciousness will not be sacrificed. Instead, the train will have many desirable comfort improvements in sound level, riding qualities, lighting, heating (electric) and air conditioning.

Construction features of the train were described at a joint Railroad—Oil and Gas Power session. First cost, operating expenses, and maintenance of trains of this design would be considerably less than present-day costs, it was pointed out.

The most apparent unusual feature of the new train is the single-axle construction. Each train consists of four two-unit, single-axle cars and one single-unit, double-axle car. The center car is provided so that cars ahead will have their single-axle forward with each trailing end suspended on the car behind. Cars to the rear of the central car will trail their axles to the rear and be suspended by the car ahead. The train is designed for either single or double-end operation; the New Haven train has two locomotives, but the NYC only one.

Rubber and Plastics. Automobile tires that may last two or three times as long as present tires, were among the possible developments in rubber technology outlined during the meeting.

Polyurethane rubbers, it was reported, will provide vastly superior abrasion and tear resistance once certain deficiencies have been worked out.

Other advances outlined included development of a synthetic rubber with characteristics identical to those of natural rubber, and development of silicone rubbers that will remain flexible for 150 hr at 500 F, for use in aircraft applications and for insulation of high-temperature-service electrical wire.

Plastics may revolutionize the world of transportation, according to another paper which described the following developments:

(1) A small airplane composed 90 per cent of plastic, exclusive of the engine, and priced $1500 under comparable metal and fabric planes; (2) several experimental automobiles with plastic bodies; (3) a plastic milk-truck tank that weighs only half as much as conventional tanks; (4) a trailer with a transparent plastic top, used for carrying textiles; (5) a U. S. parcel-post delivery truck molded from impregnated fibrous glass mat that gives a weightsaving of 1000 lb and that has passed tests showing it holds the road better because of a lower center of gravity, eliminates vibration

Dot Merrill, *center,* of Merrill & Company, explained that women engineers will become more important in industry. John Gammell, *left,* of Allis-Chalmers outlined use of trained and untrained male engineering talent, while Paul T. Eisele, *right,* of Warner & Swasey Company, evaluated the use of machinery in the development of engineering skills.

The shell-molding process, which makes the fully automatic foundry an immediate possibility, was described by James Sutherland, *right.* Mr. Sutherland, who is with Link-Belt Company, is shown chatting with Nevin L. Bean, *left,* automatic transmission division of the Ford Motor Company, who presided at the session.

thanks to its one-piece construction, and affords better interior lighting because of its translucent roof; (6) a 26-ft whaleboat, built for the U. S. Navy from polyester fiber-glass laminate, that requires no painting or caulking and that can be shipped in nests of 18 at a time, providing savings up to $150 in freight.

It was reported that 1955 has seen more consumption of plastics by the transportation industry than any other year.

A system that may create a revolution in pipe-line practice, making it almost as easy to lay pipe as squeezing toothpaste out of a tube, was described at a joint Metals Engineering—Rubber and Plastics gathering.

Particularly promising, it was noted, is the possibility of extruding plastic pipe continuously from an extruder mounted on caterpillar treads, so that it could follow a plow through the landscape. In this way, piping could be laid at a speed of several miles an hour with no joints, and thus with no leakage possibilities and no need for fitting or assembly of multiple sections. This method appears to be the method of the future for laying pipe lines over long distances. The pressure resistance will be less than that now used, but the ease and low cost of laying the lines should more than compensate for the lesser-pressure characteristics.

At the same meeting, developments in a new class of materials designed for high-temperature service—cermets—were revealed.

Cermets—a combination of ceramic and metal—have been developed in an attempt to provide materials that would permit operating temperatures in devices such as turbojet engines, gas turbines, rocket motors, and certain parts of nuclear reactors.

The cermet was defined as the aggregate or composite of a hard and refractory component intimately combined with a lower-melting metallic component to form a dense and compact body.

There now exist alloys—the so-called "super alloys"—which are suitable for use in structural parts at temperatures of 1600–1650 F. At 1750–1800 F the metal-bonded titanium carbides, which head the list of cermets, display adequate strength and toughness.

In the 1800–2200 F range, however, the cermets are too brittle, although they have adequate strength for short-time application.

It was felt, however, that materials will certainly be found for use at 1800 F, probably at 2000 F, and possibly at 2200 F.

Materials Handling. There is no such thing as an automatic or push-button plant, a Materials-Handling audience was told.

What is claimed as automation is in most cases nothing but a higher level of mechanization than previously existed, it was pointed out.

The paper was based on a study which was made recently in 15 plants considered among the most "automated" in the country.

In order to measure the extent of mechanization of any particular operation in a plant, a scale of 17 different levels of mechanization was devised.

The lowest rank is work by hand without aid of tools. Then come hand tools, powered hand tools, machine tools controlled by hand, and power tools with various automatic or remote controls. At the upper end of the scale are machines that can make limited choices and correct performance after or while operating. At the highest level is a machine that can anticipate performance, as, for instance, a self-guided missile.

Using this scale, visits to "automated plants" disclosed little or no use of the higher levels of mechanization. Existing "automation" usually does not embody self-regulation (so-called feedback control), which many automation disciples consider the only true automation. Moreover, automation usually covers a very small part of physical manufacturing and practically none of the mental activities required.

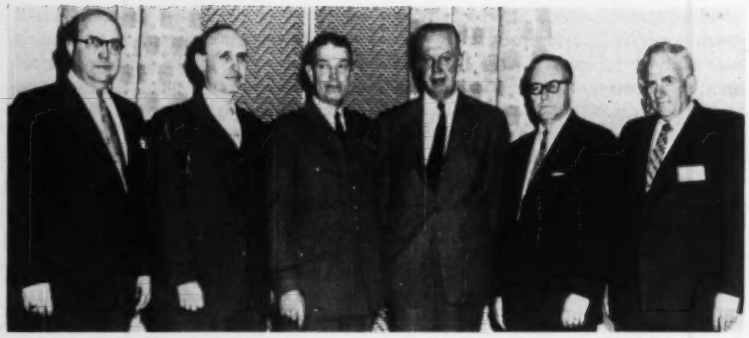
Management. Women engineers are here to stay. That word was handed down during a Management session.

According to the paper, there are about 4000 women professional engineers today, more than five times as many as there were in 1940. These women, moreover, often exceed the average requirements for men, while "engineering schools report that the majority of women enrolled are above the class average scholastically."

Women engineers seem to be accepted particularly in the aviation, electrical, and electronics-equipment industries, it was said, although almost every course of engineering admits women.

The newest designs for lightweight, low-center-of-gravity passenger-railroad equipment were presented before a joint Railroad—Oil and Gas Power technical session by B. B. Brownell, chief engineer, *left*, and William H. Harvey, co-ordinator of new products, with the Electro-Motive Division, General Motors Corporation, La Grange, Ill.

One of several women engineers speaking at the ASME meeting was Mrs. F. F. Buckland, heat-transfer engineer, *left*, who appeared before a Gas Turbine Power session. With Mrs. Buckland was J. B. Gatzemeyer, *right*, both of General Electric Company. Their subject: "Transient Temperature and Thermal Stress in a Locomotive-Gas-Turbine Bucket."



Problems in air-freight transportation were outlined by, *left* to *right*, Robert Aldrich, Airport Operators Council of the U. S.; Cuthbert C. Hurd, International Business Machines Corporation; Brig. Gen. Raymond L. Winn, Wright-Patterson Air Force Base; John C. Emery, Emery Air Freight Corporation; Robert Johnson, United Airlines; and Dudley Barrett, General Motors Corporation

It was suggested that women might help ease the current engineering shortage. The paper also decried legislation in many states which makes it impossible for a woman engineer to work more than eight hours a day, in a field where it may be necessary to work 10 to 14 hours a day for short periods in order to meet deadlines.

Nuclear Engineering. Featured at the Nuclear Engineering sessions was a panel that discussed the high lights from the Geneva Conference on Peacetime Uses of Atomic Energy. The moderator and all panel members attended the Conference in August, 1955. At another session water for nuclear power was covered. The basic concepts and factors involved in the design and testing of a once-through return generator utilizing a liquid metal as a heat source were discussed at a third session. Other papers covered aqueous homogeneous reactors for central-station power and the design and economic considerations for a 180,000-kw nuclear power plant to be constructed near Chicago using the dual-cycle boiling-water-reactor system.

American Rocket Society. The American Rocket Society, holding its 25th Anniversary Meeting in conjunction with the ASME Annual Meeting, scheduled 13 technical sessions—all at the Conrad Hilton Hotel. The papers presented covered aerodynamics, combustion, control systems, high-altitude research, instrumentation, liquid propellants, materials and design, solid propellants, space medicine, thermodynamics, and heat transfer, and a space-flight symposium.

There were, of course, many other papers on the program far too numerous to review in this limited space. A complete list of the available ASME papers presented at the Meeting may be found on pages 91-94 of this issue. In addition, digests of some of the numbered papers appeared in the December, 1955, issue of MECHANICAL ENGINEERING as well as in this issue. The remainder will be digested in forthcoming issues.

Inspection Trips and Power Show—

Inspection Trips

On Tuesday morning a group visited R. R. Donnelly and Sons Company. During the trip the visitors saw the plant as well as the complete production of *Life* and *Sports Illustrated* magazines, including the printing, assembling, binding, addressing, and shipping processes.

A tour of the Ridgeland Generating Station of the Commonwealth Edison Company was scheduled on Wednesday morning. The visitors were shown the entire station, including Unit No. 4 which exploded on Dec. 19, 1954. The unit had just been restored to service.

On Friday a group visited the Museum of Science and Industry and the German Submarine U-505. The U-505 is a captured German submarine on display at the Museum. The visitors inspected the sub and then toured the Museum.

Power Show

Leaders in the world of power and mechanical engineering converged on the Exposition of Power and Mechanical Engineering at the Chicago Coliseum. It was held under the auspices of ASME during the week of the Diamond Jubilee Annual Meeting.

The vast Exposition displayed the latest trends in plant design and industrial development and, for the first time, included an atomic-power section devoted to advances of nuclear energy in the power field.

The Exposition setup was identical with that of the National Show, traditionally presented on even calendar years and usually in New York City. This is the first time the Exposition ever was held in Chicago.

Of the 125 exhibits, some 30 were from Chicago plants and firms. They ranged from a portable steam rental service that provides steam facilities in emergencies due to boiler breakdowns to such developments as a chlorine leak detector, noise-measuring instruments, and applications of armored flexible shafting to save labor and multiply the usefulness of standard tools.

Another display of interest to industrial firms was a combination purifier and filter unit for restoring used diesel lubricating oil.

The atomic-power section included a broad survey of activity up to the present in applied nucleonics, from mineral resources and extractions to research techniques and practical applications in physics and chemistry.

Among the atomic-section displays was a scale model of a medical research reactor used in the treatment of brain tumors and another of the reactor being built near Chicago.

The Argonne National Laboratory of Lemont, Ill., featured two motion-picture films prepared for and shown at the recent International Conference on the Peaceful Uses of Atomic Energy in Geneva.

One of the films concerns the safety experiments of the boiling-water-type nuclear reactor. The other shows how electricity, produced by heat from a nuclear reactor, is supplied to Arco, Idaho—the first powering and lighting of a city in this nation with electricity from nuclear energy.

The power section presented displays in the complete range of equipment currently employed by utilities and industrial establishments. On display were exhibits of coal crushers and coal-handling equipment, arches, baffle walls, furnace linings, soot cleaners, dust collectors, and stacks; also displays of package boilers, preheaters, and economizers, condensers and heat exchangers, superheaters, steam traps, and separators.

In addition power-plant specialties, such as piping, tubing, coils, and pipe benders, couplings, flanges, and a variety of valves and controls were shown.

College Reunions and Committees

College Reunions

College-reunion luncheons and dinners were held in clubs, hotels, and restaurants all over Chicago by 21 colleges and universities this year. Taking advantage of the extensive gathering of mechanical engineers at the Diamond Jubilee Annual Meeting, some schools arranged for prominent guest speakers to address their graduates.

The following constitutes a list of the schools which held reunions: University of California luncheon at the Chicago Yacht Club; Carnegie Institute of Technology luncheon, Chicago Engineers Club; Clarkson College of Technology luncheon, Charles Harrison's Restaurant; Cooper Union dinner, Mocha Room, Hotel Congress; Cornell University luncheon, University Club of Chicago; Illinois Institute of Technology luncheon, Art Institute of Chicago; Iowa State College luncheon, Harding's Restaurant; University of Kentucky luncheon, University Club of Chicago; Louisiana State University dinner, Buckingham Room, Hotel Congress; Michigan College of Mining and Technology dinner, M.C.M. Club of Chicago; University of Missouri School of Mines and Metallurgy joint reunion dinner at Lake Shore Club; University of North Dakota luncheon, Congress Hotel; Ohio State University dinner, English Walnut Room, Congress Hotel; Pratt Institute dinner, Western Society of Engineers; Rensselaer Polytechnic Institute dinner, Harrison's Restaurant; Stevens Institute of Technology dinner, Western Society of Engineers; University of Texas dinner, University Club of Chicago; Washington University luncheon, Hotel Congress; University of Wisconsin breakfast, Buckingham Room, Hotel Congress; and Worcester Polytechnic Institute dinner, Chicago Bar Association.

Committees in Charge

ASME meetings come under the general supervision of the Meetings Committee.

The technical program is provided by the Society's professional divisions and technical committees. Other features are planned and supervised by committees organized within the host section—in this case the Chicago Section. In grateful acknowledgment of the many committees whose efforts contributed so substantially to the success of the 1955 Annual Meeting their personnel is listed in what follows:

Executive Committee: James D. Cunningham, chairman; Alex D. Bailey, Robert H. Bacon, and Charles W. Parsons.

Liaison with Chicago Section: Eugene C. Bailey, chairman; and Jay C. Marshall.

Technical Program: John T. Rettaliata, chairman; and Edward F. Obert.

Finance: Eugene P. Berg, chairman; M. J. Erisman, Andrew K. Kolar, and K. F. Lange.

Hotel: Andrew J. Snider, chairman; David S. Frank, S. K. Adkins, E. W. Brow, L. Evers, M. E. Fine, W. Laster, W. McConehie, R. Sahlstrom, and G. E. Tait.

Reception: Frank J. Hamilton, chairman; Eugene J. Carrero, J. S. Francis, Edward Gerrite, Frederick W. Hills, Tom Kuehl, H. G. McClean, G. A. Northmann, and Donald C. Wright.

Entertainment and Hospitality: Arthur B. Openshaw, chairman; Fred C. Hensel, Lawrence Anderson, Charles Clark, Wilson Herren, and M. V. Maxwell.

Plant Inspection: William H. Pletta, chairman; Kenneth W. Hamming, R. W. Patterson, T. R. Halstead, F. C. Hohenstein, R. E. Jonelis, M. K. Kalwitz, W. G. Krause, J. D. Loftis, D. C. Naulin, L. H. Niebling, S. R. Price, P. J. Robinson, R. P. Sunderland, and J. F. Tobin.

Registration, Information, and Tickets: Frank D. Cotterman, chairman; Theodore H. Gluck, Irving Grant, Leo L. Radcliff, Ralph Schmidt, and D. R. Sterba.

Publicity: John Dolio, chairman; Stewart Howe, Chester R. Earle, Walter R. Kostner, A. L. Mitchell, Oscar A. Rothchild, Harry W. Steere, Dan A. Sullivan, and Emil B. Skubic.

Annual Banquet Committee: William A. Dundas, chairman; Frederick A. Faville, Charles O. Hoban, John R. Michel, and Harry P. Swarthout.

Commemoration Committee: Paul Berndt, chairman; and Harry R. Bennett.

Associate and Student Committee: Robert J. Mindak, chairman; and Richard A. Holstedt.

Membership: Thomas S. McEwan, chairman; Edward F. Obert, and William H. Pletta.

Over-all view of company booths at Exposition of Power and Mechanical Engineering which displayed equipment ranging from atomic power to new and improved designs of power-plant and industrial manufacturing equipment

Ladies Committee: Mrs. Alexander Cowie, chairman; Mrs. Robert H. Bacon, Mrs. Eugene Bailey, Mrs. Donald J. Bergman, Mrs. Harry C. Boardman, Mrs. R. D. Cooper, Mrs. James D. Cunningham, Mrs. William Dundas, Mrs. Frederick A. Faville, Mrs. Richard S. Hartenberg, Mrs. Burgess H. Jennings, Mrs. Charles W. Parsons, Mrs. Frank P. Lawler, Mrs. Jay C. Marshall, Mrs. M. V. Maxwell, Mrs. Thomas S. McEwan, Mrs. John R. Michel, Mrs. A. B. Openshaw, Mrs. John T. Rettaliata, Mrs. Peter F. Vander Ploeg, Mrs. William E. Walsh, and Mrs. James N. Wognum.

American Rocket Society: Vincent J. Cushing, chairman; and Kenneth H. Jacobs.

American Power Conference: Roland A. Budenholzer, director.

Council Meetings

The Council of The American Society of Mechanical Engineers met in two sessions of the Society during the 1955 Annual Meeting held in Chicago, Nov. 13–18, 1955. The first session was held on Sunday afternoon and the second on Monday morning.

In addition to these sessions, the Council met with the Boards and Committees on Sunday evening to hear the progress report of the Organization Committee; and on Monday evening there was an organization meeting of the 1955–1956 Council.

Joseph Warren Barker

President of The American Society of Mechanical Engineers for 1956

Council Meeting With Boards and Committees

Following a custom established several years ago, a joint conference of members of the ASME Council, Divisions, Boards, and Committees was held on Sunday evening for the presentation and discussion of a progress report of the Organization Committee. President Morgan presided and the report was presented by J. W. Barker, President-Elect, and chairman of the Organization Committee.

Dr. Barker said that in March, 1955, the ASME Council requested the Organization Committee "to undertake a survey of the aims and objectives of the ASME as an appropriate part of our 75th Anniversary." To undertake this task the Committee asked each Regional vice-president, in consultation with his Regional Administrative Committee, to present comments. Subcommittees of the Organization Committee were set up to consult with all the Boards, Committees, Divisions, and the Secretary's headquarters staff. The 1954 Membership Survey Questionnaire was also studied. The report presented by Dr. Barker, which was in the nature of a progress report, was an attempt to suggest forward aims and objectives which the Society might wish to consider in the light of the comments received and the Committee's analysis of them.

A lively discussion followed the presentation of the report and the question of what circulation of it should be considered was discussed. It was the consensus of those present that copies should be sent to persons and committees who had contributed comments but that publication should be delayed pending further study by the Organization Committee.

Actions of the 1955 ASME Council

Request From State Department. The Secretary reported that the Society had received a request from Robert Murphy, Acting Secretary of State, that the Society accept the responsibility of acting as guide for three Russian engineers, visiting the United States on an exchange basis, and to see that they are escorted to the International Automation Exposition at the Navy Pier in Chicago, and to plants agreed upon by the State Department and the Russians. This responsibility had been accepted and Brig. General S. E. Reimel had been assigned to conduct the Russian engineers, who were accompanied by two interpreters, on their tour.

Annual Reports. The Council voted to adopt the annual report of the Council (pages 53–65 of this issue) and to accept the reports of the Boards, Commit-

tees, and representatives on joint activities. (Copies of these reports were distributed at the Annual Meeting and may be had on request to the Secretary.)

The Council also voted to receive the annual and financial reports of the Woman's Auxiliary and to express its appreciation of the outstanding achievements of that organization

Constitution and By-Laws Committee. Amendments to Article B6A, Pars. 7 and 19 (Boards and Committees), Article B6B, Par. 11 (Society Representation) Article B7, Par. 21 (Election of Officers and Directors), Article B11, Par. 9 (Sections) and Article B14, Par. 8 (Funds), which received first reading June 19–20, 1955, were adopted.

A proposed amendment to Article B5, Par. 13 (Fees and Dues) was received for first reading.

Review of Procedure for Honors. The Council discussed at length the report of the Special Committee on Review of Procedure for Honors, which had been distributed in advance. The views of the Council were presented orally and recorded by the chairman of the Committee. Thereupon, the Council voted to receive the report of the Special Committee on Review of Procedure for Honors with appreciation and to refer it back to the Committee for reconsideration for submission to the Council at its June, 1956, meeting, taking into consideration the questions raised and suggestions made at this meeting on specific recommendations; the Constitution and By-Laws Committee to be requested to submit proposed amendments to the By-Laws at the time the revised report is submitted.

Organization Committee. J. W. Barker, President-Elect and Chairman of the Organization Committee, stated that at the discussion of the preliminary report on Aims and Objectives at the Sunday evening meeting, November 13, it was the consensus of those present that the report, in its present form, should be sent to those interested and particularly to those who replied to the questionnaire preparatory to drafting the report so that they may be kept informed. A letter of transmission, drafted by Chairman Barker, was read to the members of the Council. It was voted to accept the suggestion of those present at the Sunday evening conference about distribution of the report.

Board on Technology. The Council referred to the Organization Committee the proposal of the Board on Technology to establish a standing committee to be known as the "Technical Development Committee," under the jurisdiction of the Board on Technology, the personnel and duties to be as follows, and requested the Constitution and By-Laws Committee to submit amendments to the By-Laws to provide for this Committee, if necessary:

The Committee to be composed of five members, each serving for a five-year term, one term expiring each year, and one new member being appointed each year.

The duties shall be to promote the development of technical activities in the Society by:

(*a*) Continuous surveillance of growth of scientific and engineering knowledge.

(*b*) Anticipation of need of technical-society activity in new fields of work.

(*c*) Formation of new group activity within ASME to serve the needs.

(*d*) Supervision and representation of the new activities until permanently established as a professional division or permanent committee, or until dissolved.

(*e*) Review of the status of the special committees periodically and recommendation to the Board proposing the disposition of each.

David W. R. Morgan

Retiring President of The American Society of Mechanical Engineers for 1955

Board on Membership. W. H. Larkin, chairman of the Board on Membership, pointed out that each year less than 40 per cent of the Student Member graduates apply for and accept membership in the Society. It was believed that this is primarily because the By-Laws and Rules provide too much latitude in the amount and period of dues payment and that the Rules need clarification. To rectify this situation the Board submitted proposed amendments in the Constitution and the Rules which were discussed at length and referred to the Constitution and By-Laws Committees.

The Secretary reported that the Board on Membership, at a meeting on Oct. 27, 1955, voted to endorse the recommendation of the Special Committee on Review of Procedure for Honors "that Article B4, Par. 8 be transferred to a new Section entitled 'Honors,' as the Board on Membership has no jurisdiction over the selection of Honorary Members."

Professional Practice of Consulting Engineering. At its meeting Nov. 28, 1954, the Council approved a Statement of Policy on Publicly Advertising for Bids for Professional Engineering Services, recommended by the Committee on Professional Practice of Consulting Engineering. Since that time the Committee has prepared a statement describing a procedure for implementing this policy which has been reviewed and approved by legal counsel. The Council voted to adopt the Procedure.

The Executive Committee on Sept. 22, 1955, upon the recommendation of the Committee on Professional Practice of Consulting Engineering, voted to suggest to Engineers Joint Council "that it establish a standing committee on Professional Consulting Engineering Practice for the review of current standards, development and utility, manuals, practices, etc., and recommend co-ordinated procedures for the conduct of professional consulting engineering practice."

The Secretary reported that Engineers Joint Council, on Oct. 21, 1955, voted to recommend the appointment of a subcommittee of the EJC-ECPD Joint Committee on the Practice of Engineering, to be charged with the development of overall co-ordination, co-operation, and guidance for engineers in consulting practice.

Sections. Approval was voted of the formation of the Santa Clara Valley Subsection of the San Francisco Section with the following boundaries: Entire counties of Santa Clara and Santa Cruz and all of San Mateo county south of a line drawn from the town of Half Moon Bay, Calif., to the western approach to the San Mateo toll bridge—all in the State of California.

This subsection shall serve the area in San Mateo county which is covered by the U. S. Post Offices as follows: Atherton, La Honda, Menlo Park, Redwood City, San Carlos, Woodside, Pescadero, San Gregorio, and Belmont, Calif.

Student Branches. Authorization was voted of an expenditure of $5000 to be taken from the Sections' Operation Budget to help defray expenses of Faculty Advisers attending Regional Student Conferences, the method of distribution to be determined by the Vice-Presidents.

It was voted that the Student Member winning first prize in each of the twelve Regional Student Conferences be invited to the 1956 Semi-Annual Meeting in Cleveland, Ohio, at the expense of the Old Guard Committee, to compete for a cash award of $150 to be given by the Old Guard Committee on recommendation of the Board on Honors and the Council, the winner to be the guest of the Old Guard Committee at the 1956 Annual Meeting.

At the request of the Executive Committee on Sept. 22, 1955, the Vice-Presidents reconsidered their previous action, and upon their recommendation, the Council voted to approve the adoption of the following policy in order to strengthen the professional attitudes of Students and Faculty:

(*a*) Each Faculty Adviser to be made a member of the nearest Section executive committee.

(*b*) Each Section to program one or more panel discussions by members of the medical, legal, and architectural professions.

(*c*) Each Regional Student Conference to include a similar panel discussion, and

(*d*) A committee appointed by the Vice-Presidents to prepare a pamphlet giving a broad picture of the professions of law, medicine, and architecture; David W. R. Morgan and W. F. Thompson to serve as members of the committee.

The Mexico Section was authorized to encouraged active participation in the Section by engineering students and to authorize that a yearly subscription to MECHANICAL ENGINEERING be made available to these students through the Mexico Section at the rate of $3.50.

The Southern California Section was authorized to encourage active participation in the Section by engineering students and yearly subscription to MECHANICAL ENGINEERING is to be made available to the students at UCLA through the Southern California Section at the rate of $3.50.

RAC Meetings. Upon recommendation of the Vice-Presidents the Council voted that the budget policy setting mileage rate for travel to RAC meetings be modified to reduce the rate from 13 cents per mile to 11 cents per mile, for the year 1955–1956 only.

Society "Operating Years." Attention was called to the difficulties the Vice-Presidents encounter in connection with the various operating years which the Society follows. It was suggested that this be given serious consideration, and the Council voted to request the Organization Committee to study the conflict between the various operating years of the Society—administrative, fiscal, Section, Student Branch, and calendar.

75th Anniversary Awards. Special 75th Anniversary awards were granted to Samuel B. Earle (Greenville Section) and Robert Bullis (Polytechnic Institute of Brooklyn).

ECPD. Approval was voted of the sponsoring by Engineers' Council for Professional Development of a comprehensive survey of the engineering profession. (See MECHANICAL ENGINEERING, December, 1955, pages 1144–1147.)

The Council again considered the matter of inviting the National Society of Professional Engineers, as a result of a communication received from S. L. Tyler, Executive Secretary of ECPD, dated June 16, 1955, asking that the constituent bodies which withheld approval reopen the matter. On Jan. 19, 1955, the Executive Committee of ASME considered the matter and withheld action. The Council discussed this at length and considered carefully the presentations by W. H. Larkin and W. F. Ryan, ASME representatives on ECPD, pointing out that it would be advantageous for NSPEE to become a member of ECPD.

The Council voted to go on record as favoring an invitation to the National Society of Professional Engineers to become a member of Engineers' Council for Professional Development.

The Council voted to suggest to ECPD Executive Committee that the liaison between ECPD and NSPE, on those ECPD Committees in which NSPE can be immediately helpful, be established at once;

To ask ECPD to give urgency to considerations of the revision of its Charter as voted at its May 26, 1955, meeting; and

To urge Engineers Joint Council, through its NSPE-EJC Conference Committee to place again before NSPE the desirability of membership in EJC.

New Engineering Societies Building. The personnel of the Task Committee on New Engineering Societies Building has been organized and has selected its chairman and temporary secretary; also, an executive committee has been selected consisting of one member each of the five societies, E. G. Bailey representing the ASME.

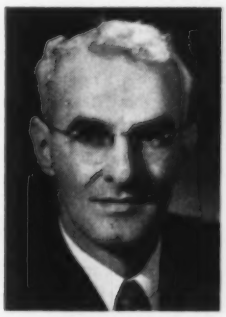
George Westinghouse. The Secretary reported that George Westinghouse, who was an Honorary Member of the Society and who served as President in 1910, was elected on Nov. 1, 1955, to the Hall of Fame, New York University, New York. He was elected on the fourth nomination by the Society, starting in 1940 (elections are made every five years). The bronze bust of George Westinghouse for the Hall of Fame was given to the Society by

New Members of the 1956 ASME Council

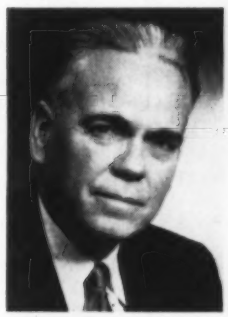
Charles E. Crede
Vice-President, Region I

Frank W. Miller
Vice-President, Region III

A. C. Pasini
Vice-President, Region V



B. T. McMinn
Vice-President, Region VII

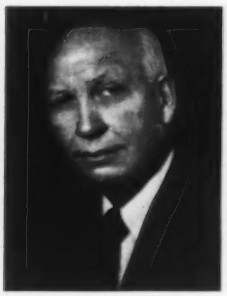


Glenn B. Warren
Director

J. F. Downie Smith
Director

Louis Polk
Director

Elmer O. Bergman
Director



Joseph Pope
Director

his brother, Herman Westinghouse, in 1928, to be held in custody until such time as he was elected.

Elmer A. Sperry Award. The Secretary reported that an additional sum of $2000 has been contributed to the Elmer A. Sperry Award, making the total $18,000. This additional amount was contributed "so the capital investment will in no way be drawn upon for preliminary expenditures including medal, certificate, and honorarium for the first year." The Council acknowledged this contribution with sincere appreciation.

Ely C. Hutchinson. The members of the Council noted with regret the death, on Nov. 12, 1955, of Ely C. Hutchinson who served as Manager of the Society 1928–

1931 and as Vice-President, 1933–1935.

Certificates of Award. Certificates of award were granted to: Carl B. Weidner and A. P. Batchelor of the Shreveport Group; to Frank W. Zurn, J. C. Jefferds, Jr., J. J. Vicker, and Philip Freneau, to members of regional committees, and to the following retiring Section chairmen:

Leon B. Saunders, Akron
Floyd F. Dedrick, Boston
Harold B. Ratcliff, Central Illinois
Maurice Olchoff, Central Iowa
D. M. Goldzwig, Dayton
Walter Locke, Delaware
J. F. Bailey, East Tennessee
R. W. Holland, Eastern North Carolina
Karl Reed, Erie
S. M. Watson, Jr., Greenville
Ralph J. Andrews, Jr., Hartford
Henry S. Aurand, Hawaii
Dudley F. Phelps, Metropolitan
Jos. L. O'Neill, Mid-Hudson
R. D. Teece, Milwaukee
James A. Quaid, Philadelphia
Harold K. Couch, Piedmont-Carolina
D. W. VerPlanck, Pittsburgh
Robert B. Parker, Providence
George R. Leavitt, Rochester
J. T. Moore, Shreveport Subsection
H. H. Meredith, Jr., South Texas
A. Wiley Sherwood, Washington
Otis F. Lamson, Jr., Western Washington
Edwin L. Pace, Worcester

1956 ASME Council Organized

At the organization meeting of the 1956 ASME Council, David W. R. Morgan, the retiring President, received an expression of the "sincerest appreciation and grateful thanks for his outstanding contribution to the Society's activities during his administrative year and for his generous contribution of time devoted to visits to 39 Sections and 22 Student Branches throughout the country." The special President's pin and the special 75th Anniversary Medal were also presented to Dr. Morgan.

Appointments. The following appointments were made:

C. E. Davies, secretary of the Society, for the year ending Nov. 26, 1956.

O. B. Schier, 2nd, and Thomas A. Marshall, Jr., assistant secretaries, for a one-year period.

D. C. A. Bosworth, assistant secretary and controller; and Stanley A. Tucker, assistant secretary and publications business manager, for a one-year period.

Joseph L. Kopf, treasurer, and Edgar J. Kates, assistant treasurer, for the year ending Nov. 26, 1956.

Joseph L. Kopf, treasurer of the Development Fund, for one year ending Nov. 26, 1956.

Members of the Executive Committee of the Council were appointed as follows: Joseph W. Barker, chairman, Frank W. Miller, A. C. Pasini, Frank L. Bradley, and Louis Polk.

Assignment of Directors. The following directors were assigned to the Boards and Committees named:

Board on Codes and Standards, E. O. Bergman and Louis Polk

Board on Education and Professional Status, R. L. Goetzenberger

Board on Honors, H. C. R. Carlson

Board on Membership, H. C. R. Carlson

Board on Public Affairs, R. L. Goetzenberger

Board on Technology, G. A. Hawkins, R. B. Lea, J. F. Downie Smith, and G. B. Warner

Finance Committee, Joseph Pope

Organization Committee, F. L. Bradley. David W. R. Morgan was also assigned to this Committee for a two-year term to replace R. J. S. Pigott.

Special Committees of the Council. On recommendation of the Organization Committee, certain special committees of the Council were continued, and the Nuclear Energy Application Committee and the Society Policy Committee were disbanded with a vote of appreciation for their accomplishments.

Delegation of Functions to Boards. The Council voted to delegate to the Board on Technology and the Board on Codes and Standards for the period Nov. 14, 1955, to Nov. 26, 1956, certain functions recorded in the minutes of the Council.

Business Meeting

1955 Annual Business Meeting

The Annual Business Meeting of The American Society of Mechanical Engineers was held in the Florentine Room of the Congress Hotel, Chicago, Ill., on Monday afternoon. President David W. R. Morgan presided.

C. E. Davies, secretary of the Society, highlighted the Annual Report of the Council and the reports of the Boards, Committees, and representatives to joint bodies. L. N. Rowley, Jr., chairman of the Finance Committee, summarized the annual report of that Committee.

Mr. Rowley said that Society income for 1954-1955 had exceeded that of any other year, and that the budget for 1956 had been set up on the basis of a lower income. He spoke about the Committee's program of investment diversification and certain changes that had been made in the handling of funds.

[The report of the Council and the report of the Finance Committee are printed in full in this issue. The reports of the Boards and Committees were distributed at the meeting and may be obtained by request to the Secretary.]

Certain financial statements required by law were entered into the record of the meeting, and members present stood for a moment of silence as the Secretary entered into the record the names of members who had died during the year.

On motion the transactions of the Society and the Council for the fiscal year 1954–1955 were approved.

The Secretary read the report of the tellers for the election of officers and the President called on each newly elected officer to stand. The officers elected are: Joseph W. Barker, President; Charles E. Crede (Region I), Frank W. Miller (Region III), Albert C. Pasini (Region V), and Bryan T. McMinn (Region VII), vice-presidents; and J. F. Downie Smith (1956), Elmer O. Bergman (1957), Louis Polk (1959), Joseph Pope (1959), and Glenn B. Warren (1959), directors. Biographies of these officers appeared in MECHANICAL ENGINEERING, August, 1955, pages 741–746.

President Morgan then declared these officers elected, to take office on Nov. 15, 1955. He spoke of the enthusiasm with which Dr. Barker had conducted the affairs of the Organization Committee which he served as chairman in 1954–1955. Dr. Barker then spoke briefly in acknowledgement of the honor paid to him in his election.

John O. Hayter, Jr., of the Shreveport Sub-Section of the Mid-Continent Section, expressed to the Society the thanks of his fellow members for the establishment of that Sub-Section, approved by the Council at the 1955 Semi-Annual Meeting.

Henry H. Snelling, of the Washington, D. C., Section, commented on the establishment of an ASME Student Branch at Howard University, authorized by the Council at the 1955 Semi-Annual Meeting, and suggested that a list of recipients of 75th Anniversary Medals to prominent members of ASME Sections be published. The Secretary reported that portraits of all these recipients were to appear in the December, 1955, issue of MECHANICAL ENGINEERING.

The President then described briefly the "Old Guard" and told of its activities.

Availability List for 1955 ASME Annual Meeting Papers

THE PAPERS in this list are available in separate copy form until October 1, 1956. Please order only by paper number; otherwise the order will be returned. Copies of these papers may be obtained from the ASME Order Department, 29 West 39th Street, New York 18, N. Y.

Paper No.	Title and Author

Applied Mechanics

55—A-1	Studies in Dynamic Photoelasticity, by M. M. Frocht and P. D. Flynn
55—A-2	Large Deflections of Elliptical Plates, by N. A. Weil and N. M. Newmark
55—A-3	Analysis of Short Thin Axisymmetrical Shells Under Axisymmetrical Edge Loading, by G. Horvay, C. Linkous, and J. S. Born
55—A-4	Displacements in an Elastic-Plastic Cylindrical Shell, by P. G. Hodge, Jr.
55—A-5	Stress Function for Rotating Plates, by P. G. Hodge, Jr.
55—A-7	General Solutions of the Equations of Elasticity and Consolidation for a Porous Material, by M. A. Biot
55—A-8	Theory of Plastic Buckling of Plates and Application to Simply Supported Plates Subjected to Bending or Eccentric Compression in Their Plane, by P. P. Bijlaard
55—A-9	The Effect of the Earth's Rotation on Laminar Flow in Pipes, by G. S. Benton
55—A-11	Determination of Natural Frequencies of Continuous Plates Hinged Along Two Opposite Edges, by A. S. Veletsos and N. M. Newmark
55—A-12	Theoretical Determination of Rigidity Properties of Orthogonally Stiffened Plates, by N. J. Huffington, Jr.
55—A-13	Unsteady Radial Flow of Gas Through Porous Media—Variable Viscosity and Compressibility, by J. S. Aronofsky and J. D. Porter
55—A-14	The Load-Carrying Capacity of Circular Plates at Large Deflection, by E. T. Onat and R. M. Haythornthwaite
55—A-15	Combined Stress Tests in Plasticity, by Aris Phillips and Lloyd Kaechele
55—A-16	Stress Concentration Caused by Multiple Punches and Cracks, by Michael Sadowsky
55—A-17	A Matrix Solution for the Vibration Modes of Nonuniform Disks, by F. F. Ehrich
55—A-18	On Axially Symmetric Bending of Nearly Cylindrical Shells of Revolution, by R. A. Clark and E. Reissner
55—A-19	Bending Vibrations of Variable-Section Beams, by E. T. Cranch and Alfred A. Adler
55—A-20	Asymmetrical Bending of a Cylindrically Aeolotropic Tapered Disk, by E. S. Baclig, Jr., and H. D. Conway
55—A-21	Bending Creep and Its Application to Beam-Columns, by L. W. Hu and N. H. Triner
55—A-23	The Pattern of Plastic Deformation in a Deeply Notched Bar With Semicircular Roots, by L. Garr, E. H. Lee, and A. J. Wang
55—A-24	The Nonlinear Bending of Thin Circular Rods, by H. D. Conway
55—A-28	Pretwisted Beams and Columns, by John Zickel
55—A-32	Stiffness of Curved Circular Tubes With Internal Pressure, by P. G. Kafka and M. B. Dunn
55—A-33	On the Wake Energy of Moving Cascades, by N. H. Kemp and W. R. Sears
55—A-34	The Stress Distribution in a Strip Loaded in Tension by Means of a Central Pin, by P. S. Theocaris
55—A-35	Effect of an Acoustic Medium on the Dynamic Buckling of Plates, by F. L. Dimaggio
55—A-36	On Some Problems in Bending of Thick Circular Plates on an Elastic Foundation, by Daniel Frederick
55—A-37	A Method of Stepwise Integration in Problems of Impact Buckling, by A. F. Schmitt
55—A-38	A Suction Device Using Air Under Pressure, by L. F. Welanetz
55—A-39	Buckling of Simply Supported Plates Tapered in Planform, by Bertram Klein
55—A-40	On the Torsion of Rectangular Sandwich Plates, by Paul Seide
55—A-41	Bending and Torsion of Circular Cylinder Cantilever Beams of Cylindrically Aeolotropic Material, by W. S. Ericksen
55—A-42	A Theory of the Yield Point and the Transition Temperature of Mild Steel, by F. Forscher
55—A-43	Creep Stresses and Deflections of Columns, by T. H. Lin
55—A-44	Effect of Hub Radius on the Vibrations of a Uniform Bar, by W. E. Boyce
55—A-45	Some Dynamic Properties of Oil-Film Journal Bearings With Reference to the Unbalance Vibration of Rotors, by A. C. Hagg and G. O. Sankey
55—A-46	Analysis of Creep in Rotating Disks Based on the Tresca Criterion and Associated Flow Rule, by A. M. Wahl
55—A-47	Propagation of a Sudden Rotary Disturbance in an Elastic Plate in Plane Stress, by J. N. Goodier and W. E. Jahsman
55—A-48	Theoretical Considerations of Combined Thermal and Mass Transfer From a Vertical Flat Plate, by E. V. Somers
55—A-49	Plastic Deformation of Semi-Infinite Beams Subject to Transverse Impact Loading at the Free End, by M. F. Conroy
55—A-50	High-Frequency Extensional Vibrations of Plates, by T. R. Krane and R. D. Mindlin
55—A-51	Comparison of Slip-Line Solutions With Experiment, by E. G. Thomsen
55—A-52	On the Ideally Plastic Indentation of Inset Rectangular Bands, by E. W. Ross, Jr.
55—A-59	A Study of Axisymmetric Vibrations of Cylindrical Shells as Affected by Rotatory Inertia and Transverse Shear, by T. C. Lin and G. W. Morgan
55—A-60	Momentum Diffusion From a Slot Jet Into a Moving Secondary, by A. S. Weinstein, J. F. Osterle, and W. Forstall
55—A-78	Flexural Vibrations of Rectangular Plates, by R. D. Mindlin, A. Schacknow, and H. Deresiewicz
55—A-79	Studies on Plastic Flow of Anisotropic Metals, by L. W. Hu
55—A-80	Analysis of Slip Damping With Reference to Turbine-Blade Vibration, by L. E. Goodman and J. H. Klumpp
55—A-81	A Method for Calculating Stress-Concentration Factors, by M. Hetenyi and T. D. Liu
55—A-82	Tensor-Flexibility Analysis of Pipe-Supporting Systems, by J. W. Soule
55—A-83	The Solution of Multiple-Branch Piping-Flexibility Problems by Tensor Analysis, by J. W. Soule

55—A-84 Critical Thickness of Surface Film in Boundary Lubrication, by I-Ming Feng and C. M. Chang

55—A-85 Plastic Twisting of Thick-Walled Circular Ring Sectors, by W. Freiberger and W. Prager

Aviation

55—A-86 Air Freight—A Blueprint For 1965, by J. C. Emery

Education

55—A-163 The Creative Engineer, by J. E. Arnold

55—A-211 Evaluation, Distribution, and Training of Creative Men, by J. A. Anderson

Fuel

55—A-56 Pulsating, Pressure-Generating Combustion Systems for Gas Turbines, by F. H. Reynst

55—A-95 Ash Deposits On Boiler Surfaces From Burning Central Illinois Coal, by J. R. Michel and L. S. Wilcoxson

55—A-118 Flow Characteristics Of Aerated Crushed Coal, by Charles H. Marks, Peter R. Broadley, and John I. Yellott

55—A-185 Combustion Calculations For Multiple Fuels, by T. Buna

55—A-193 The Sintering Test: An Index to Ash-Fouling Tendency, by D. H. Barnhart and P. C. Williams

55—A-200 Bonded Fireside Deposits in Coal-Fired Boilers: A Progress Report on the Manner of Formation, by C. H. Anderson and E. K. Diehl

55—A-201 Upgrading Burner Performance of Distillate Fuel Oils by Hydrogen Treatment, by R. P. Gilmartin, W. A. Horne, and B. R. Walsh

55—A-213 Improvement of Distillate Fuels by Additive and Refining Techniques, by J. P. Kirchner, D. P. Osterhout, and W. R. Schwindeman

Gas-Turbine Power

55—A-120 Effect of Turbine-Blade Cooling on Efficiency of a Simple Gas-Turbine Power Plant, by W. M. Rohsenow

55—A-121 The Filtration of No. 6 Fuel Oil to Remove Undesirable Trace Metals, by C. H. Shields, Jr.

55—A-122 Correlation of Fir-Tree-Type Turbine-Blade Fastening Strength With Mechanical Properties of Materials, by A. G. Holms and A. J. Repko

55—A-146 Some Design Aspects of the Free-Piston Gas-Generator-Turbine Plant, Part I—Thermodynamics and Component Characteristics, by S. L. Soo and W. A. Morain

55—A-147 The Supercharged-and-Intercooled Free-Piston-and-Turbine Compound Engine—A Cycle Analysis, by A. L. London

55—A-155 Some Design Aspects of the Free-Piston Gas-Generator-Turbine Plant, Part II—Controls and Accessories, by W. A. Morain and S. L. Soo

55—A-158 Tests of an Experimental Coal-Burning Turbine, by D. L. Mordell and R. W. Foster-Pegg

55—A-179 Transient Temperature and Thermal Stress in Locomotive Gas-Turbine Buckets, by Mrs. F. F. Buckland and J. B. Gatzemeyer

55—A-184 Combination Gas-Turbine and Steam-Turbine Cycles, by M. A. Mayers, A. Matiuk, and S. Baron

55—A-186 The Thermodynamics of Cooled Turbines, Part I—The Turbine Stage, by W. R. Hawthorne

55—A-191 The Thermodynamics of Cooled Turbines, Part II—The Multistage Turbine, by W. R. Hawthorne

55—A-202 Application of Internal Liquid Cooling to Gas-Turbine Rotors, by Sumner Alpert and Delson D. Drake

Heat Transfer

55—A-6 The Viscosity of Steam, Heavy-Water Vapor, and Argon at Atmospheric Pressure Up to High Temperatures, by C. F. Bonilla, S. J. Wang, and H. Weiner

55—A-25 Laminar Free-Convection Heat Transfer From the Outer Surface of a Vertical Circular Cylinder by E. M. Sparrow and J. L. Gregg

55—A-26 Experimental Study of the Temperature Distribution in Plates During Arc Welding, by R. J. Grosh and R. A. Hawkins

55—A-27 Residual Stresses in Cold Extruded Aluminum, by J. Frisch and E. G. Thomsen

55—A-30 Combined Forced and Free-Convective Heat Transfer in a Horizontal Pipe, by J. J. Martin and M. B. Carmichael

55—A-31 Engineering Relations for Heat Transfer and Friction in High-Velocity Laminar and Turbulent Boundary-Layer Flow Over Surfaces With Constant Pressure and Temperature, by E. R. G. Eckert

55—A-55 The Air-Cooled Electronic Chassis, by Melvin Mark and Mark Stephenson

55—A-58 The New Zealand Thermal Area and Its Development for Power Production, by C. J. Banwell

55—A-61 Solution of Transient Heat-Transfer Problems by the Resistance-Network Analog Method, by G. Liebmann

55—A-65 Cooling of Glass Molds, by Rudolf L. Wille

55—A-73 Combined Forced and Free-Laminar Heat Transfer in Vertical Tubes With Uniform Internal-Heat Generation, by T. M. Hallman

55—A-88 Convection Phenomena in Fluids From Below, by S. Ostrach

55—A-90 Mean-Temperature Difference in One and Three-Pass Crossflow Heat Exchangers, Part I—Countercurrent Exchangers, by R. A. Stevens and J. R. Woolf

55—A-97 Flow-Sampling and Discharge Measurement in Geothermal Bores, by C. J. Banwell

55—A-100 Free-Convection Heat Transfer From a Horizontal Right Circular Cylinder to Freon 12 Near the Critical State, by D. L. Doughty and R. M. Drake, Jr.

55—A-101 The Determination of Heat-Transfer Coefficients for Air and Carbon Dioxide, by E. L. Katz

55—A-104 An Investigation of Convection Heat Transfer in a Porous Medium, by S. M. Marco and L. S. Han

55—A-106 The Transfer of Heat and Momentum in a Turbulent Stream of Mercury, by H. E. Brown, B. H. Amstead, and B. E. Short

55—A-107 Temperature-and-Velocity Distribution in Turbulent Flow of Mercury, by B. H. Amstead, H. E. Brown, and B. E. Short

55—A-108 Mass-Transfer Cooling in a Laminar Boundary Layer With Constant Fluid Properties, by J. P. Hartnett and E. R. G. Eckert

55—A-109 Seal Leakage in the Rotary Regenerator and Its Effect on Rotary-Regenerator Design for Gas Turbines, by D. B. Harper

55—A-129 High-Speed Guarded-Hot-Plate Apparatus for Thermal Conductivity of Thermal Insulation, by E. V. Somers

55—A-133 Turbulent Flow and Heat Transfer on a Flat Plate at High Mach Number With Variable Fluid Properties, by R. G. Deissler and A. L. Loeffler, Jr.

55—A-141 Graphical Methods for the Temperature Response of Bodies in a Varying-Temperature Medium, by F. Landis and J. O. Tearnen

55—A-154 Liquid-Droplet Heating and Evaporation in a High-Temperature Gas Stream, by J. W. Rizika

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55—A-127 The Design of Axial-Flow Pumps, by R. D. Bowerman

55—A-130 Hydraulic-Turbine-Runner Vibration, by R. M. Donaldson

55—A-136 Thermodynamic Aspects of Cavitation in Centrifugal Pumps, by H. A. Stahl and A. J. Stepanoff

55—A-142 Turbulence and Boundary-Layer Effects on Cavitation Inception From Gas Nuclei, by J. W. Daily and V. E. Johnson, Jr.

55—A-144 Critical Considerations on Cavitation Limits of Centrifugal and Axial-Flow Pumps, by Dr. G. F. Wislicenus

55—A-145 Suppression of Pump Vibrations Set Up at Starting Up—Pre-opening Method, by F. Numachi

55—A-156 The Slotted-Blade Axial-Flow Blower, by Dr. H. E. Sheets

55—A-157 Closed Systems for Testing Compressors, by R. M. Johnson

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55—A-22 Vortex-Tube Free-Air Thermometry, by L. S. Packer and H. C. Box

55—A-64 Hydraulic Power Steering—Effects of Valve Characteristics and Steering-Wheel Inertia, by W. E. McCarthy and W. A. Van Wicklin

55—A-70 Use of Nonlinear-Valve Characteristics in the Control of a Simple Blending Process, by J. L. Shearer

55—A-91 Terminology of Process-Control Valves, by W. D. Washburn and R. Milham

55—A-105 Procedures for Evaluation of Control-Valve Mechanical Characteristics, by J. T. Ward and Otto Kneisel

55—A-110 Procedures for Evaluating Dynamic Characteristics of Valve Operators, by Andrew Bremer

55—A-111 Sonic Pneumatic Measurements of Lengths and Their Applications, by A. L. A. Fortier

55—A-113 Practical Limitations of Current Materials and Design of Control Valves, by H. H. Gorrie and W. L. Gantz

55—A-114 Some Hydrodynamic Aspects of Valves, by F. F. Ehrich

55—A-126 Design Basis for Multiloop Positional Servomechanisms, by Sidney Lees

55—A-138 Effects of Adjacent Piping Configurations on Control-Valve Characteristic and Capacity, by G. F. Brockett and W. J. L. Kennedy

55—A-152 Test Procedures for the Evaluation of Control-Valve Flow Performance, by C. M. Johnson and J. M. Fallis

Joint ASTM-ASME Committee

55—A-173 Structural Stability of Modified 12-Chromium Alloys, by W. C. Hagel and E. F. Becht

55—A-204 Mechanical Properties at Elevated Temperatures of Ductile Cast Iron, by F. B. Foley

Lubrication

55—A-212 The Maximum Temperature Profile in Journal Bearings, by O. Pinkus and B. Sternlicht

55—A-216 Temperature Distribution in the Journal-Bearing Lubricant Film, by M. B. Purvis, W. E. Meyer, and T. C. Benton

Machine Design

55—A-66 The Spring Back of Metals, by F. J. Gardiner

55—A-68 Effect of Range of Stress in Combined Bending and Torsion Fatigue Tests of 25S-T6 Aluminum Alloy, by W. N. Findley, W. I. Mitchell, and D. D. Strohbeck

55—A-76 Selection and Application of Spring Materials, by Harold C. R. Carlson

55—A-77 The Influence of Shank Area on the Tensile Impact Strength of Bolts, by J. Love, Jr. and O. A. Pringle

55—A-93 Design Improvements in Industrial Electrical Motors and Controls, by T. Turner and C. Lynn

55—A-94 The Diesel-Engine's Progress and Future, by Mark Ogden and Bruce W. Wadman

55—A-96 The Pursuit of Happiness, by Alfred V. Bodine

55—A-99 Mechanization on the Farm, by A. E. W. Johnson

55—A-117 Load Ratings for Miniature Ball Bearings, by T. S. Kauppinen and R. H. Carter

55—A-177 Design Study of a Hydrostatic Gas Bearing With Inherent Orifice Compensation, by S. K. Grinnell and H. H. Richardson

55—A-178 Dynamics of Instrument-Bearing Torque Testing, by F. V. Johnson

Materials Handling

55—A-165 The Mechanization Profile—A Tool for Measuring Automation, by James R. Bright

55—A-166 Pneumatic Conveying as Adapted to the Milling Industry, by F. G. Jun and E. J. Gehrig

55—A-167 Recognition of Materials Handling in Its Entirety for Proper Evaluation, by R. B. Gesse

55—A-168 Materials-Handling Analysis, Southern Plant, National Lead Company, by T. J. Eddy

55—A-169 More Movement—Less Investment—More Profit, by F. C. Wier

55—A-170 Some Basic Concepts Relating Materials-Handling Costs to Over-All Production Costs, by B. W. Saunders

55—A-171 Analysis of Air-Freight Operation, by J. K. Morris

Metals Engineering

55—A-10 Bending and Impact Tests . . . of Cast-Iron, Cast-Steel, and Nodular-Iron Valve Bodies, by J. O. Jeffrey and R. H. Hanlon

55—A-149 On the Applicability of Notch Tensile Test Data to Strength Criteria in Engineering Design, by J. D. Lubahn

55—A-150 The Use of Nodular Iron in Switchgear, by F. E. Florschutz

55—A-151 Certain Departures From Plastic Ideality at Small Strains, by H. A. Lequear and J. D. Lubahn

55—A-175 Creep Damage in a CR-MO-V Steel as Measured by Retained Stress-Rupture Properties, by M. H. Jones, W. F. Brown, Jr., and D. P. Newman

55—A-196 The Development of Cermets as Structural Materials, by J. T. Norton

55—A-197 Effect of Surface Finish on the Fatigue Strength of Titanium Alloys RC 130B and Ti 140A, by G. M. Sinclair, H. T. Corten, and T. J. Dolan

55—A-198 Experiences in Production Vacuum Melting of Nickel-Base Alloys, by F. N. Damara and J. S. Huntington

Oil Gas and Power

55—A-57 A Rational Approach to Crankshaft Design, by C. M. Lowell

Petroleum

55—A-176 A Review of Mechanical-Engineering Progress in the Petroleum Industry, by E. N. Kemler

Power

55—A-54 A System of Charging for Steam in Industrial Plants With Power Generation, by L. J. Sforzini and C. A. Winslow, Jr.

55—A-62 Turbine Supervisory Instruments, by J. C. Spahr and R. L. Richards

55—A-69 Factors Influencing the Dynamic Behavior of Tall Stacks Under

the Action of Wind, by M. S. Ozker and J. O. Smith

55—A-87 Plant Management and Other Factors Affecting Maintenance Cost in Steam-Generating Stations, by V. F. Estcourt

55—A-128 Maintenance Factors Affecting Production Costs, by W. F. Oberhuber and C. W. Watson

55—A-135 First Commercial Supercritical-Pressure Steam Generator for Philo Plant, by W. H. Rowand and A. M. Frendberg

55—A-137 First Commercial Supercritical-Pressure Steam-Electric Generating Unit For Philo Plant, by S. N. Fiala

55—A-143 Design of a Large Coal-Fired Steam Generator for 200 F Exit-Gas Temperature and Operating Experience With Pilot Plant, by W. L. Wingert and R. J. Stanley

55—A-159 First Commercial Supercritical-Pressure Steam Turbine—Built for the Philo Plant, by C. W. Elston and R. Sheppard

55—A-172 Investigation of Large Steam-Turbine Spindle Failure, by H. D. Emmert

55—A-174 Maintenance Control in Steam Power Plants, by G. V. Williamson

55—A-189 Test of a Once-Thorugh Steam Generator With a Liquid Metal as a Heat Source, by J. J. Morabito and R. H. Shannon

55—A-192 Fluid Flow Through Two Orifices in Series III—The Parameters of Metastable and Stable Flow of Hot Water, by W. J. Kinderman and E. W. Wales

55—A-194 Acceptance Guides for Ultrasonic Inspection of Large Rotor Forgings, by A. W. Rankin and C. D. Moriarty

55—A-199 Status of Demineralizing for Treatment of Boiler Feedwater in Today's Power Plants, by V. J. Calise

55—A-208 Report of the Investigation of Two Generator-Rotor Fractures, by C. Schabtach, E. L. Fogleman, A. W. Rankin, and D. H. Winne

55—A-210 Report of the Investigation of the Turbine-Wheel Fracture at Tanners Creek, by A. W. Rankin and B. R. Seguin

55—A-214 Dresden Nuclear-Power Station Preliminary Design and Economics, by T. G. LeClair

55—A-215 Large Rotor Forgings for Turbines and Generators, by R. E. Peterson, N. L. Mochel, J. D. Conrad, and D. W. Gunther

55—A-219 Aqueous Homogeneous Reactors for Producing Central-Station Power, by R. B. Briggs

Power Test Codes Committee

55—A-205 A Practical Application of Uncertainty Calculations to Measured Data, by L. W. Thrasher and R. C. Binder

55—A-206 Instrumentation for Steam-Consumption Tests on Medium Steam-Turbine-Generator Sets, by D. E. Kimball

Process Industries

55—A-160 Industrial Application of Ceramics, by E. J. Smoke and J. H. Koenig

55—A-218 Application of Superheated Vapor Atmospheres to Drying, by A. M. Lane and Stuart Stern

Production Engineering

55—A-148 Research Problems in Production Routing and Scheduling, by A. J. Rowe and J. R. Jackson

55—A-162 Foundry Automation and the Shell-Molding Process, by J. Sutherland

Railroad

55—A-131 History and Development of the ACF Talgo, by J. R. Furrer

55—A-132 Adhesion—How Much? An Investigation of the Causes of Low Wheel-to-Rail Adhesion and Possible Methods of Improving It, by F. G. Fisher and R. K. Allen

55—A-134 Practical Considerations in New Railway Passenger-Car Designs, by A. G. Dean

55—A-139 Service Testing of Freight Cars, by O. C. Maier

55—A-140 Pullman-Standard's Train X, by T. C. Gray

55—A-187 Progress in Railway Mechanical Engineering, 1954–1955, by D. R. Meier

Research Committee

55—A-63 Evaluation of the Prototype Unit for the ASME High-Temperature Steam-Generation Investigation, by Bela Ronay, W. E. Clautice, and W. F. Erskine

55—A-67 An Analysis of the Orthogonal-Boring Operation, by Bernard W. Shaffer

55—A-92 Pulsation Errors in Manometer Gages, by T. J. Williams

55—A-102 Experimental Superheater for Steam at 2000 Psi and 1250 F—Report After 14281 Hours of Operation, by J. Hoke and E Eberle

55—A-112 Design of Corrugated Diaphragms, by J. A. Haringx

55—A-115 Corrugated - Metal - Diaphragm Performance, by A. V. Kankel and D. C. Whitten

55—A-116 Recent Research on Flat Diaphragms and Circular Plates With Particular Reference to Instrument Applications, by A. M. Wahl

55—A-123 Influence of Grinding Fluids Upon Residual Stresses in Hardened Steel, by H. R. Letner

55—A-125 Some Studies of Angle Relationships in Metal Cutting, by J. H. Creveling, T. F. Jordan, and E. G. Thomsen

55—A-153 The Work of the Central Electricity Authority (Britain) on the Fouling and Corrosion of Boiler Plant, by Dr. H. E. Crossley

55—A-180 A Bibliography on Diaphragms and Aneroids, by G. H. Lee and L. M. Van der Pyl

55—A-181 Investigations of the Properties of Corrugated Diaphragms, by W. A. Wildhack, R. F. Dressler, and E. C. Lloyd

55—A-183 Metal Transport in Liquid Water Systems and Effect on Heat Transfer, by S. C. Datsko

55—A-188 A Practical Pulsation Threshold for Flowmeters, by V. P. Hoad

55—A-203 High-Temperature Corrosion of Alloys Exposed in the Superheater of an Oil-Fired Boiler, by D. W. McDowell, Jr., R. J. Raudebaugh, and W. E. Somers

55—A-217 Heat Transfer to and Temperature Distribution in a Metal-Cutting Tool, by D. L. Rall and W. M. Giedt

Rubber and Plastics

55—A-207 The Engineer in the World of Commerce and Industry, by D. L. Gibb

Water Hammer

55—A-71 Water-Hammer Calculations and Test Results—Owens Gorge Power Plant Penstocks, by A. E. Bratfisch and K. O. Cartwright

55—A-72 Hydraulic Transients in Centrifugal-Pump Systems, by C. P. Kittredge

55—A-74 Water-Column Separation in Pump-Discharge Lines, by R. T. Richards

55—A-75 Surge-Wave Velocity—Concrete Pressure Pipe, by H. F. Kennison

Wood Industries

55—A-190 Manufacture of Synthetic Lumber in Germany, by A. Elmendorf, Dr. W. Klauditz, and Dr. A. Lühning

Comments on Papers

Including Letters From Readers on Miscellaneous Subjects

Plea for "Controversial" Papers

To the Editor:

"He's only an engineer!" This cry comes frequently from the public in its ignorance of what an engineer does.

One cause of the cry is the failure to publish professional engineering papers that show clearly how engineers are working for the public welfare. Instead we have professional papers so highly technical that the public finds difficulty in seeing any relationship to lower costs and shorter working hours.

Young engineers particularly and many older ones find it difficult to think in terms of economics. They become enthused over a new design or operating method and forget the important question of how it compares in capital and operating costs with others.

Examples of such highly technical papers are the following:

1 "Chatter Vibration of Lathe Tools," ASME Paper No. 55—SA-22.

2 "A Study of the Speed of Sound in Porous Granular Media," ASME Paper No. 55—APM-37.

3 "The Analysis of Dynamic Stresses in Aircraft Structures During Landing as Nonstationary Random Processes," ASME Paper 55—APM-32.

Such technical papers are necessary but let's leaven them with subjects of more popular appeal.

An occasional paper approaches the characteristics necessary for public appreciation of the engineer such as the following:

1 "Fluid-Coker Mechanical-Design Aspects," ASME Paper No. 55—PET-6.

2 "Fire-Protection Equipment for Pipe Lines and Terminals," ASME Paper No. 55—PET-13.

But even here the titles listed lack the wording necessary to arouse public interest and certainly they lack data on comparative costs, reduction in working hours, or increased safety so necessary to arouse public appreciation. An engineer knows that recommendations in most engineering papers lead to the increased welfare of the public but the problem is to dramatize those recommendations so the public sees the possibilities.

Concerning every engineering recommendation, the employer and even more the public needs estimates of what is involved in lower or shorter working hours, in greater production, in more or less pay, in increased personal satisfactions, in greater safety, and in lower or increased capital and operating costs.

Engineers frequently shy away from such estimates, in professional papers particularly, as some assumptions have to be made. At best those estimates have to be approximate and engineering societies dislike them. Yet how else can most engineers show their interest in public welfare? Without such estimates, the engineer's paper becomes only a clever study of a possibility by a technician instead of a broad-gage discussion by a technologist.

In addition to such technical papers as the preceding, if made with estimates of costs and other human factors, engineers should be discussing even more "controversial" subjects such as the following:

1 *Increasing the Sale of Anthracite.* The drop in sales of anthracite has come in part from too many small dealers; from poor service to the anthracite user compared with that furnished the oil user; from public ignorance of labor-saving devices possible in burning anthracite; and from factors beyond the scope of this paper. An engineer's discussion of the preceding would be so vital to every home owner, it would be reported in the newspapers. Labor would be interested for increased sales of anthracite means more work for miners. The public's favorable impression of engineers would rise. The cry, "He's only an engineer!" would not be heard as he is no longer a technician but has become a technologist.

2 *Obsolescence in the Woolen Industry.* Much of the woolen industry is moving from New England to the South in order to lower manufacturing costs. What can be done by New England to discourage this movement? Some of the factors involved are obsolete multistory factory buildings, high real-estate taxes, and the use of old-fashioned machinery. But a paper discussing this subject would be controversial. It would not discuss pure engineering only but would have to discuss comparative costs and to do so often have to make assumptions open to attack. The paper, however, would be reported in the newspapers as it would have real interest for residents of New England (and the South) who see their property being abandoned and their livelihoods disappearing. The engineer discussing the subject would not be a technician on some minor engineering development but would have to be a technologist.

The Ed Sullivan show on TV has pointers for engineers if they wish more public approval. Various factors account for its success. One is a shrewd combination of news and human interest. The two subjects suggested herein for professional papers have numerous elements of news and human interest if properly described.

Various other examples could be given of controversial subjects that should be discussed by engineers if they wish to reach high professional stature. An example of an engineer who did not hesitate at controversy, and who is a member of the ASME, is Morris Llewellyn Cooke. See "Life and Times of a Happy Liberal," by Kenneth E. Trombley, Harper & Brothers, New York, N. Y., 1954.

It was reviewed in the May, 1955, issue of Mechanical Engineering, pages 453–454.

A cry similar to, "He's only an engineer!" is not heard of lawyers and doctors. They do not hesitate to discuss controversial subjects.

Lawyers live on controversy. Their activities pro and con are reported by the newspapers. The public sees that lawyers are working for somebody at all times. So nobody says, "He's only a lawyer!"

Doctors advance their standing through controversy. At conventions, they are frequently discussing new methods or new medicines for some disease even if their success has not been completely proved. The newspapers re-

port the discussion, particularly if controversially hopeful. So the public gives recognition to doctors who are always working in its behalf.

Thus engineers who seek high standing with the public must introduce in their professional papers the controversial aspects. They must on every possible occasion discuss costs, hours of work, personal satisfactions, and safety. Then the public will cry, "Get that engineer on this job!"

Gregory M. Dexter.[1]

NSPE Position on State Licensing Laws

To the Editor:

The August, 1955, issue of Mechanical Engineering carries a letter to the editor from Mr. Gregory M. Dexter in which the statement is made that the National Society of Professional Engineers "agreed this past year to accept a provision that two thirds of the directors of an engineering corporation must be licensed professional engineers."

Mr. Dexter's statement is in error as the National Society of Professional Engineers had not adopted the position indicated nor any other provision respecting the number of directors of a corporation who should be licensed professional engineers.

We have been quite interested in the matter of corporate practice of engineering and have had the several viewpoints on this question presented to the Society at recent meetings. The Board of Directors has not, however, adopted any Society policy on the detailed aspects of the problem.

At the meeting in Charlotte, North Carolina, in February, 1955, the Board of Directors did adopt a resolution stating in substance that NSPE supports its State Societies in any attempt to obtain revision of the state engineering registration law in which licensing of qualified individuals to practice engineering is the basic concept of professional status, irrespective of the type of business organization in which the professional engineer is a member.

We will appreciate your publication of this letter in order that readers of Mechanical Engineering will not be misinformed about NSPE's stand.

Allison C. Neff, P.E.[2]

[1] Consulting Engineer, Scarsdale, N. Y. Life Member ASME.

[2] President, National Society of Professional Engineers, Washington, D. C.

Pumping in Sealed Systems

Comment by T. Ravese[3]

In their paper[4] on hermetically sealed pumps the authors have made a valuable contribution to industry. Considerations of fluid properties and operating conditions make this pump appear attractive in certain applications.

This type of pump has certain advantages over a conventional pump with injection-type seal which can be summarized as follows:

1 The external auxiliary piping is limited to low-pressure cooling water.

2 Less weight and headroom requirements.

3 Start-up procedure simpler.

There are certain factors as follows which partly offset these advantages:

1 Increased initial cost (partly offset because of no injection-water requirements).

2 Lower over-all efficiency.

3 Possible higher cost of maintenance parts.

The pump operating data reported were obtained with water of exceptional purity because of AEC requirements. Such is not generally the case in industry and bearing service may be more severe.

Fig. 9 of the paper shows the effect of shutting off low-pressure cooling water on the lower-end winding temperature. The pumped water temperature is 450 F and the lower-end winding temperature is 390 F, a difference of 60 deg F. If the pumped water temperature is 600 F and the same temperature difference applies, then the lower-end winding temperature is 540 F. If a pump were so operated for short periods what is the effect on winding insulation and bearing life?

Many pumps are operating satisfactorily today with injection-type seals. If the pump described is to be competitive then the price must be in line with other conventional pumps to make it attractive. In many applications, austenitic materials may not be required as was the case with the AEC application, and less-expensive materials can be substituted.

Authors' Closure

Mr. T. Ravese's comments are particularly appreciated since they represent the commercial viewpoint on this type of apparatus.

Increased initial cost, including those of spare parts, is recognized as a deterrent to widespread use; however, the field is still new and cost reductions can be anticipated.

Considering all the factors, it is believed that the over-all efficiency is equal to, and in some cases better than, conventional arrangements of the same size.

It is believed that the exceptional water purity experienced in nuclear applications is not so different from the water conditions in boiler circulating systems as to cause any serious concern. This factor, however, is one which only time and experience will prove conclusively.

The pumps are not designed for the conditions where cooling water is shut off; however, in case of emergency, the silicone-insulated windings will not be damaged by temperatures in the 540 F region for a few hours, presumably the time required to restore cooling water. Decrease in service life would be theoretically finite but inappreciable.

B. Gametti.[5]
C. J. Mei.[6]

[3] Field Test Engineer, Combustion Engineering, Inc., New York, N. Y. Mem. ASME.

[4] "Hermetic Motor Pumps for Sealed Systems," by B. Cametti and A. J. Mei, Mechanical Engineering, vol. 77, June, 1955, pp. 488–494.

[5] Manager, Pump Engineering, Westinghouse Electric Corporation, Atomic Equipment Department, Cheswick, Pa.

[6] Atomic Equipment Department, Westinghouse Electric Corporation, Cheswick, Pa. Assoc. Mem. ASME.

Importance of Engineering Science

Comment by James I. Clower[7]

To the Editor:

On page 571 of the July, 1955, issue of Mechanical Engineering Dean Hollister in his article "Importance of Engineering Science" states: "You will recall that thirty years ago a major number of our engineering colleges were teaching mechanics without the use of the calculus."

I am confident that this statement is quite incorrect. In 1925 as now most of our engineering colleges started with algebra, trigonometry, and analytic geometry in the freshman year followed with a four or five-hour credit calculus course throughout the sophomore year. The first course in mechanics, statics, was and is now given by most engineering schools during the second semester of the sophomore year. At this point the student has had one semester of calculus and is taking the second calculus course. The other mechanics courses (kinetics, dynamics, fluid mechanics, etc.) followed in the junior year just as they do

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today in most engineering curricula. Calculus was used in these courses just as much twenty-five years ago as it is today. Most engineering schools still have four-year curricula as they did twenty-five years ago. This makes it impossible to arrange any other sequence other than the foregoing.

In fact, I would not be surprised if an investigation were made it would show that somewhat more calculus were employed in teaching mechanic courses twenty-five years ago than is today. More total credit hours of mechanics were given and these courses were more rigorous. We were not so squeamish about failing students in those days as we are now. It was more of a life of sink or swim.

Comment by Paul H. Black[8]

In his article, "Importance of Engineering Science on the Future of the Profession,"[9] Dean Hollister has again made a learned appraisal of the role of engineering teaching in the future of the profession. He has given homage to the contributions of Professor Timoshenko to the teaching of mechanics and has pointed out that progress in this area has been so stimulating that it now serves as an inspiration to other fields of engineering. He has nicely distinguished between the work of the scientist and the engineer.

The writer wishes to remark about two points in the article: Dean Hollister implies that people working in the field of mechanics may deal with situations involving stresses, corrosion, fatigue, high temperature, and surface phenomena.

The mechanics divisions of some of our manufacturing companies deal with all of these and others including fluid flow, metallurgy, and electricity, but the mechanics departments of undergraduate engineering schools usually confine their courses to fundamental principles of mechanics and properties of common materials.

As a commentary, two of the fields related to machine design which are presently undergoing considerable development, namely, lubrication and machining of metals, have had most of their progress outside of engineering-college mechanics departments which indicates that there are areas in mechanics more challenging to the engineer than to the scientist.

It appears to the writer that such a situation is warranted since the task of endowing the student with fundamental principles of mechanics is important enough to warrant a full-time job.

To pass on to machine design, the fields which are required as a background include, besides conventional mechanics, the production processes including machining of metals, metallurgy, lubrication and wear, quality control, kinematic design, motor selection, also thermal considerations as for brakes, gears, and bearings.

More than ten years ago Dean Hollister stated that a course in machine design should have as its main objective the *integration* of all of the foregoing fields.

There is no doubt that development in the field of mechanics has shown in the past twenty-five years more internal progress than machine design. The reason for this is partly due to the susceptibility of mechanics to the mathematical approach as compared with machine design which involves a very considerable range of interrelated fields, of which mechanics is one, and which in combination cannot be expressed as an equation.

[8] Professor of Mechanical Engineering, Ohio University, Athens, Ohio. Mem. ASME.

[9] "Importance of Engineering Science on the Future of the Profession," by S. C. Hollister, Mechanical Engineering, vol. 77, July, 1955, pp. 571–572; also, *Applied Mechanics Reviews*, May, 1955.

Reviews of Books

And Notes on Books Received in Engineering Societies Library

Gear Design

Practical Gear Design. by Darle W. Dudley. McGraw-Hill Book Company, Inc., New York, N. Y., 1954. Cloth, 6 × 9 in., figs., tables, problems, references, index, x and 335 pp., $7.

Reviewed by F. Richardz[1]

The author has made a real effort to give the gear designer "to-be" a good insight in the ramification of gear design as well as the more accomplished gear designer a good source to refresh his memory. The book is well illustrated by pictures and sketches covering design of gearing for marine, aviation, and industrial application. Fundamental and preliminary design data is included for the novice; in addition, the most accepted gearing formulas and design data have been made available for those more accomplished in the art of gearing design. Methods of manufacture and tools required for economical production are covered sufficiently to guide the designer as well as manufacturing engineers. Formulas are included to give relative time values for various methods of production which should be of specific interest to manufacturing engineers and time-study engineers. The book includes reference to the most common gear materials in use as well as suggested hardness of the material to avoid the most common types of gear-tooth failures. Gearing design is generally considered to be not only a science, but also an art as it requires a tremendous amount of "know-how," and the author has given this phase of the gearing problems special attention by introducing examples and problems which, if properly followed, should be of considerable value to the gear designer.

The material presented in this book is, to a great extent, extracted from known sources such as the "American Gear Manufacturers Standards (AGMA)," "Earl Buckingham," "Gleason Works," and so on, and put up in such a manner that it becomes, to a great degree, self-sufficient.

The author has been liberal with his bibliographic references. The book is well written and contains information necessary for every gear designer; therefore both the novice as well as the more

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advanced design engineer and time-study men and manufacturing personnel will find the book interesting, educational, and full of facts and figures.

Books Received in Library

ANNOTATED BIBLIOGRAPHY ON NOISE, ITS MEASUREMENT, EFFECTS AND CONTROL. Industrial Hygiene Foundation of America, Inc., Mellon Institute, Pittsburgh Pa., 1955. 364 p., $8^7/_8 \times 6^1/_8$ in., paper. $7.50. Over 2000 references are arranged chronologically under subject subdivision of four major sections: noise measurement, effects of noise, measurement of hearing loss, and noise reduction and control. Most of the references are from the period 1927 to 1953 and include foreign titles as well as English. Representative articles are annotated or abstracted, and subject and author indexes are included.

AUTOMATIC FACTORY—WHAT DOES IT MEAN? (Report of Conference, Margate, June, 1955.) The Institution of Production Engineers, London, England, 1955. 228 p., $11^1/_4 \times 8^1/_2$ in., bound. 25s. The papers in this report present a broad review of the technical and human problems of automation, with particular reference to implications for the British economy. The impact of the automatic factory on management, labor, engineering schools, and society generally are dealt with in some of the papers; others discuss such subjects as automatic transfer machines, automatic inspection, computer-controlled machine tools, automatic control in the petroleum industry, automatic-linking devices, and automatic selection, weighing, and conveying. Descriptions of equipment displayed at the conference are included.

COMBUSTION RESEARCHES AND REVIEWS, 1955. (Agardograph 9.) Advisory Group for Aeronautical Research and Development, Butterworths Scientific Publications, London, England (distributed in the U. S. by Interscience Publishers, Inc., New York, N. Y.), 1955. 187 p., $10 \times 6^1/_4$ in., bound. $5. This volume includes fourteen papers devoted to the discussion of various aspects of the combustion of fuel sprays, carbon formation, diffusion flames, flame stabilization, and spray formation. It also contains a French-English glossary of combustion terms with a diagram of a gas-turbine combustion chamber explaining some of the terms in the glossary.

BEARING LUBRICATION ANALYSIS. By R. R. Slaymaker. John Wiley & Sons, Inc., New York, N. Y., 1955. 108 p., $9^1/_4 \times 6$ in., bound. $5. A concise treatment of fundamentals written for students majoring in machine design and for practicing engineers, unfamiliar with the subject. The discussion, centered on sleeve bearings, covers viscosity and other properties of oil, hydrodynamic theory as a basis for design, characteristics of materials, oilless bearings, and an approximate method for predicting temperature rise. Case studies and numerical examples are included.

DMT—DIMENSIONAL MOTION TIMES. Development and Application. By H. C. Geppinger. John Wiley & Sons, Inc., New York, N. Y., 1955. 100 p., $11 \times 8^1/_2$ in., paper. $4. This is a report of a research project undertaken to develop a systematic procedure for analyzing work in terms of motions, and for measuring the work content by predetermined time values which are related to distances and other dimensional terms. The report includes a summary of the development of the system, five tables of data by which factory operations may be determined, and examples of typical applications.

DIESEL ENGINEERING HANDBOOK. 1955 edition. Revised and edited by A. B. Newell. Diesel Publications, Inc., New York, N. Y., ninth edition, 1955. 835 p., $9^1/_4 \times 6^1/_4$ in., bound. $8. This standard manual gives detailed information on the diesel cycle, fuels and fuel systems, combustion, engine components, frames and cylinders, speed governors, supercharging, lubrication, cooling systems, and dual-fuel engines. Representative engines of various makes and types are described and complete specifications are tabulated for all diesels currently manufactured as separate power units. Marine diesels are treated in a separate chapter as well as in the tabulation.

DIESEL ENGINE PRINCIPLES AND PRACTICE. Edited by C. C. Pounder. Philosophical Library, Inc., New York, N. Y., 1955. Various paging, $8^3/_4 \times 5^3/_4$ in., bound. $17.50. A survey of theory, construction, and applications, prepared by a group of British experts as a text for students and reference manual for diesel engineers. Compression-ignition engine principles, fuels, lubricating oils, torsional vibration, balancing, crankcase explosions and other generally applicable subjects are discussed, and the different types of engines—vehicle and tractor, locomotive, air-cooled, dual fuel, and others—are separately treated. Concluding sections cover vibration and noise, testing, and maintenance.

L'ÉQUILIBRE DES CORPS DÉFORMABLES. By G. Colonnetti. Dunod, Paris, France, 1955. 162 p., $9^3/_4 \times 6^1/_4$ in., bound. 1680 F fr. This treatment of the equilibrium of deformable bodies is divided into five parts: general theory of equilibrium; plastic deformation; analysis of lattice girders; new theory of girders and arches; the prestressed condition. The basic classical theories are dealt with briefly as the reader is assumed to have some groundwork in the mechanics of materials and in the mathematical theory of elasticity.

DIE DIN-VERZAHNUNGSTOLERANZEN UND IHRE ANWENDUNG. (Schriftenreihe Antriebstechnik, no. 13.) By G. Apitz and others. Friedr. Vieweg & Sohn, Braunschweig, Germany, 1954. Various paging, $9^3/_8 \times 6^3/_4$ in., bound. 14.80 DM. A discussion of German standard gear-tooth tolerances which covers economic significance, the setting up of a tolerance system, comparisons with other countries' practice, and the practical value of proper tolerances. The full text of the German standards is given in an appendix along with graphical representations of some of the text material.

ENGINEERING METALLURGY. By L. F. Mondolfo and Otto Zmeskal. McGraw-Hill Book Company, Inc., New York, N.Y., 1955. 397 p., $9^1/_4 \times 6^1/_4$ in., bound. $7.50. Intended as a text for engineering, students whose primary field is not metallurgy, this book emphasizes the theoretical reasons behind the various operations described. The latter include melting and casting, plastic working, heat-treatment, welding, powder metallurgy, and corrosion. Other subjects covered include origin and extraction of metals, theory of alloys, and properties and uses of commercial metals and alloys.

FIFTH SYMPOSIUM (INTERNATIONAL) ON COMBUSTION. Combustion in Engines and Combustion Kinematics. By the Standing Committee on Combustion Symposia of the Combustion Institute. Reinhold Publishing Corporation, New York, N. Y., 1955. 802 p., $10^1/_4 \times 7$ in., bound. $15. Forty-five of the 101 papers in this volume are concentrated on the chemical kinetics of combustion reactions, with half of these devoted to the combustion of hydrocarbons. Of the remaining papers, fourteen are on engine combustion; twenty on droplet burning, liquid propellants, and solids; and sixteen on diffusion flames, special techniques, spectra, and dissociation energies. The papers are fully illustrated and contain lists of references.

GEAR DESIGN AND PRODUCTION. By Reginald Trautschold. Columbia Graphs, Columbia, Conn., 1955. 204 p., $9^1/_4 \times 6^1/_4$ in., bound. $4.50. A restatement of basic principles accompanied by proofs of rules and formulas for critical computations. Each of the various standard classes of gears—spur, bevel, spiral, etc.—are taken up separately, and chapters on methods of production, materials, and inspection are included.

GERADFÜHRUNGEN DURCH DAS GELENKVIERECK. By Robert Kraus. Deutscher Ingenieur-Verlag, Düsseldorf, Germany 1955. 204 p., $8^1/_2 \times 6$ in., bound 28.50 DM. This book presents the most important methods of kinematic synthesis as applied to the design of straight-line motion mechanisms. The methods are geometrical and are fully illustrated. A table is given which lists possibilities of choice of the various construction elements. There is no index to the volume.

DIE GRUNDGESETZE DER WÄRMEÜBERTRAGUNG. By H. Gröber and S. Erk. Third edition revised by Ulrich Grigull. Springer-Verlag, Berlin, Germany, 1955. 428 p., $9^1/_4 \times 6^1/_4$ in., bound. 37.50 DM. Covering the fundamentals of heat transmission, this standard test is divided into three main sections: thermal conductivity in solid bodies; convective heat transfer; thermal radiation. It is designed for use by both practicing engineers and advanced students. This new edition has been brought up to data and considerably rewritten where necessary.

GUIDANCE. By Arthur S. Locke. D. D. Van Nostrand Company, Inc., New York, N. Y., 1955. 729 p., $9^1/_4 \times 6^1/_4$ in., bound. $12.50. This volume, one in a series entitled "Principles of Guided Missile Design," treats the devices and techniques used to guide missiles. It includes basic information drawn entirely from unclassified literature on fundamental problems; locating targets by infrared, radio, and acoustic waves; fixing targets by terrestrial or celestial reference; and the mathematics essential for solving guidance problems. Among the other subjects covered are related servo-system theory, the analysis of flight trajectories, and analog and digital simulation.

HANDBOOK OF ENGINEERING MATERIALS. Edited by Donald F. Miner and John B. Seastone. John Wiley & Sons, Inc., New York, N. Y., 1955. Various paging, $8^1/_2 \times 5^1/_2$ in., bound. $17.50. Designed to meet the need of engineers for a convenient single source for data on the usual materials of manufacturing and construction, this handbook gives essential information concisely and suggests sources of more complete information. Arrangement is by classes of related or similar materials under three broad groups—metals, non-metals, and construction materials. In

general, information given includes grades, properties, applications, sources of supply, and, where pertinent, design, fabricating, and other data. The first section provides general information on specifications, standards, constants, etc., and there is a detailed subject index.

HANDBOOK OF INDUSTRIAL ENGINEERING AND MANAGEMENT. Edited by W. G. Ireson and E. L. Grant. 1955, Prentice-Hall, Inc., New York, N. Y. 1203 p., $9^1/_4 \times 6^1/_4$ in., bound. $16. In addition to covering the traditional subjects such as time study, plant layout, etc., this new handbook contains sections on engineering economy, budgeting, standardization, safety engineering, industrial hygiene, quality control, industrial statistics, and operations research. Intended both as reference manual and text, the treatment stresses general principals and the best current practice.

HAWLEY'S TECHNICAL SPELLER. Compiled by Gessner G. Hawley and Alice W. Hawley. Reinhold Publishing Corporation, New York, N. Y., 1955. 146 p., $7^1/_2 \times 5$ in., bound. $2.95. This book contains over 8000 technical words selected from the vocabularies of chemistry, physics, electronics, biology, medicine, engineering, and other fields of science and technology. Recommended word divisions are indicated. A separate list gives the correct prepositions for use after certain words.

HOW TO SOLVE PROBLEMS IN ENGINEERING KINEMATICS. Engineering Mechanics—Book II. By Stephen J. Tracy, Jr., 166-24 26th Avenue, Flushing, 58, N. Y., 1955. 223 p., $8^1/_2 \times 5^1/_4$ in., paper. $2.25. A series of progressive problems illustrating basic principles of velocities and accelerations in mechanisms. Step-by-step solutions by the graphical method are included. The first book in the series emphasized the use of the analytical method in the solution of problems in elementary mechanics.

HÜTTE—DES INGENIEURS TASCHENBUCH. Volume 1, Theoretische Grundlagen. Edited by Akademischen Verein Hütte. Wilhelm Ernst & Sohn, Berlin, Germany, twenty-eighth edition, 1955. 1668 p., $7^1/_4 \times 5$ in., bound. 56 DM. A comprehensive handbook of engineering fundamentals, this volume includes separate sections on mathematics, physics, heat, vibration, mechanics, strength of materials, chemical and physical properties of metals and nonmetals, and measurements. An appendix gives conversion tables for the American, English, and metric systems. Extensive additions have been made to the material of the previous edition.

INDUSTRIAL FURNACES. Volume II. By W. Trinks. John Wiley & Sons, Inc., New York, N. Y., third edition, 1955. 358 p., $9^1/_4 \times 6$ in., bound. $10. Vol. 2 of this well-known treatise is devoted primarily to practice and is intended especially to aid in the selection, installation, and operation of furnaces. The text covers fuels and sources of heat energy, combustion devices, and heating elements, control of furnace temperature and atmosphere, and comparison of fuels and types of furnaces. Much of the book has been rewritten, and much new information has been added, including a chapter on safety measures.

INDUSTRIAL LUBRICATION PRACTICE. By Paul D. Hobson. Industrial Press, New York, N. Y., 1955. Various paging, $9^1/_4 \times 6^1/_4$ in., bound. $8. Intended for lubrication engineers and others needing basic information on modern practice, this book treats, in the early chapters, principles and basic techniques, plain and antifriction bearings, and lubrication routine and handling in a large manufacturing plant. Later chapters deal with hydraulic systems and equipment, the lubrication of specific machines and devices, cutting fluids, and the preservation of machinery in transport and storage.

INDUSTRIAL POWER SYSTEMS HANDBOOK. Edited by Donald Beeman. McGraw-Hill Book Company, Inc., New York, N.Y., 1955. 971 p., $9^1/_4 \times 6^1/_4$ in., bound. $12.50. Modern engineering practice in the design of electrical facilities for industrial plants and commercial buildings are covered in seventeen chapters prepared by various contributors. The book deals with economic aspects of the subject as well as with technical problems of short-circuit protection, voltages, grounding, and system design. A chapter on modernization of existing power systems is included.

INDUSTRIAL TRIANGLE. By Fred H. Colvin. Columbia Graphs, Columbia, Conn., 1955. 172 p., $8^3/_4 \times 5^3/_4$ in., bound. $3.50. The author considers a series of topics involving the interrelationship of the three factors that ensure profitable and continuous production: proper machine equipment, efficient management, and dependable labor. The discussion covers such subjects as annual wages, incentives, feather bedding, and automation as it affects labor and management. Practical suggestions for maintaining industrial peace are made to both management and labor.

INSPECTION AND TESTING OF METALS. The Institution of Metallurgists, London, England, 1954. 120 p., $8^3/_4 \times 5^1/_2$ in., paper. 15s, 6d. The five lectures included deal with the inspection of engineering plants in service, inspection in the steel industry, inspection of nonferrous metals, destructive and nondestructive test methods, and batch testing and sampling. The paper devoted to nonferrous metals is accompanied by a bibliography of 75 references.

DER INSTATIONÄRE WÄRMEÜBERGANG IN DIESELMOTOREN. (Mitteilungen aus dem Institut für Thermodynamik und Verbrennungsmotorenbau an der E.T.H., Zürich, no. 15.) By Karl Elser. Verlag Leemann, Zürich, Switzerland, 1954. 79 p., $9^1/_2 \times 6^1/_8$ in., paper. 1250 Sw.fr. A contribution on unsteady-state heat transfer in diesel engines covering theory, methods of measurement and analysis, and the results of tests on both 2-cycle and 4-cycle engines.

INSTRUMENT ENGINEERING. Volume 3: Applications of the Instrument Engineering Method. Part 1: Measurement Systems. By Charles Stark Draper, Walter McKay, and Sidney Lees. McGraw-Hill Book Company, Inc., New York, N. Y., 1955. 879 p., $11^1/_8 \times 8^3/_4$ in., bound. $17.50. This volume contains examples in which the theory, methods, and techniques described in the first two volumes are applied to specific measurement problems. The discussion deals with instruments ranging from thermometers with the simplest possible performance equations to vibration-measuring equipment and covers electromechanical devices, pressure-measuring systems, integrators and differentiators, and analog computers.

INSTRUMENTS FOR MEASUREMENT AND CONTROL. By Werner G. Holzbock. Reinhold Publishing Corporation, New York, N. Y., 1955. 371 p., 9×6 in., bound. $10. Nine chapters of this book are devoted to descriptions of the operational characteristics and, in many cases, the structural details of instruments commonly used in industrial plants for measuring temperature, humidity, pressure, flow, and other process variables. Five chapters deal with various control devices—electric, pneumatic, hydraulic, etc.—and the last chapter briefly summarizes recent trends in the use of centralized control systems.

INTRODUCTION TO PROCESS CONTROL SYSTEM DESIGN. By A. J. Young. Longmans, Green and Company, Inc., New York, N. Y., 1955. 378 p., $8^3/_4 \times 5^3/_4$ in., bound. $8. A treatment of basic principles using the frequency-response approach and employing only the necessary minimum of mathematics. Descriptions of various types of controllers and control systems are given, and methods for the calculation of their characteristics shown. The analysis of plant characteristics is also dealt with as a basis for design of controls for more efficient production both in existing and new plants.

INTRODUCTION TO THE THEORY OF AEROELASTICITY. By Y. C. Fung. John Wiley & Sons, Inc., New York, N. Y., 1955. 490 p., $9^1/_4 \times 6$ in., bound. $10.50. The main body of this book on the effect of aerodynamic forces on elastic bodies is in two parts. Chapters 2 to 11 cover the historical background, physical concepts, and principles of analysis of aeroelastic problems, including various problems in civil and mechanical engineering, flutter, transient loads, and gusts. Chapters 12 to 15 present the fundamentals of oscillating airfoil theory, and a brief summary of experimental results. Basic principles of aerodynamics, elasticity, and mechanical vibration are reviewed in the first chapter.

JAHRBUCH DER WISSENSCHAFTLICHEN GESELLSCHAFT FÜR LUFTFAHRT, 1953. Edited by Hermann Blenk. Friedr. Vieweg & Sohn, Braunschweig, Germany, 1954. 224 p., $11^3/_4 \times 8^1/_4$ in., bound. 28 DM. Recent research work in aerodynamics is presented in the twenty-four papers included in this volume. Sample topics are airfoil analysis, incompressible-flow theory, vibration of blades, shock waves, supersonic flight, rocket propulsion, etc. Most of the articles are in German or French but have English summaries.

KORROSION UND KORROSIONSSCHUTZ. Edited by Fritz Tödt. Walter de Gruyter & Co., Berlin, Germany, 1955. 1102 p., $9^3/_4 \times 6^3/_4$ in., bound. 68 DM. A comprehensive reference book for engineers in all fields on all aspects of corrosion and corrosion protection. The five main sections cover the following: fundamentals, and intercrystalline and stress corrosion; corrosion characteristics of different metals; methods of corrosion protec-

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ENGINEERING Societies Library books may be borrowed by mail by ASME Members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th St., New York 18, N. Y.

tion; corrosion problems in various industries; corrosion test methods. Special emphasis is given to the recent German, English, and French literature, with more than 4500 references cited in extensive chapter bibliographies or included as footnotes. An appendix contains general tables, a history of corrosion to 1900, and a detailed subject index.

MACHINE DESIGN. By Paul H. Black. Second edition, 1955, McGraw-Hill Book Company, Inc., New York, N. Y. 471 p., $9\frac{1}{4} \times 6\frac{1}{4}$ in., bound. $7.50. Intended both as a text and as a reference book for design offices, this book covers the fundamentals of the design of machine elements and the design and selection of units of power transmission, of strength, rigidity, wear, and economy of manufacture and operation. The practical aspects are emphasized, including the important factors leading to failure and the latest treatment of stress concentration.

MACHINE TRANSLATION OF LANGUAGES. Edited by William N. Locke and A. Donald Booth. Massachusetts Institute of Technology and John Wiley & Sons, Inc., New York, N. Y., 1955. 243 p., $9\frac{1}{4} \times 6$ in., bound. $6. The fourteen essays of which this book is composed deal with many aspects of the subject, from detailed treatments of the linguistic difficulties to the mechanical problems involved such as the storage memory devices. The approach is essentially philological in character but some actual methods of mechanized translation are described as well as the results of one of the first practical experiments.

THE NEW AMERICAN MACHINIST'S HANDBOOK. Edited by Rupert LeGrand. Based upon earlier editions edited by Fred H. Colvin and Frank A. Stanley. McGraw-Hill Book Company, Inc., New York, N. Y., 1955. Various paging, $8\frac{1}{4} \times 5\frac{1}{2}$ in., bound. $11. A successor to the standard reference work by Colvin and Stanley, this handbook for engineers, machinists, and others in the metalworking industry is comprised of forty-five sections grouped in the following eleven parts: machining; metal-forming; assembly methods; materials; metal finishing; inspection; fasteners; tool engineering and drafting; machine-tool standards; power-transmission equipment; and mathematics and tables. The emphasis throughout is on up-to-dateness, comprehensiveness, and practicality.

PLASTICS FOR CORROSION-RESISTANT APPLICATIONS. By Raymond B. Seymour and Robert H. Steiner. Reinhold Publishing Corporation, New York, N. Y., 1955. 423 p., 9×6 in., bound. $7.50. The aim of this book is to provide reliable information which will permit the proper application of plastic materials in corrosive atmospheres. The various plastics and resins are discussed in the form in which they are applied—coatings, linings, impregnants, adhesives, pipes, etc.—and information is given on the comparative chemical resistance of these materials. A separate section provides a guide to the selection of plastics for specific corrosion problems.

POWER PLANT MANAGEMENT. By Robert Henderson Emerick. McGraw-Hill Book Company, Inc., New York, N. Y., 1955. 339 p., $9\frac{1}{4} \times 6\frac{1}{4}$ in., bound. $6.50. A guide intended to aid all levels of management in making decisions regarding the design, administration, and operation of power plants. Such subjects as the most suitable method of power generation, storage of fuels, the outdoor power plant, specification writing, safety, training of personnel, smoke prevention, maintenance, etc., are treated from the standpoint of the executive who wants to produce dependable power at low cost. Detailed mathematical analysis has been avoided in the discussion of engineering problems.

PRACTICAL PLANT LAYOUT. By Richard Muther. First edition, 1955, McGraw-Hill Book Company, Inc., New York, N. Y. 363 p., $11\frac{1}{4} \times 8\frac{1}{2}$ in., bound. $12. This practical treatment of layout techniques and procedures discusses the factors influencing layout materials, machinery, manpower, etc., and gives step-by-step directions for planning the arrangement of equipment and work areas. Basic features of types of layouts and their relation to production are dealt with in introductory chapters, and the role of management as discussed in the final chapter. Detailed examples, case illustrations, and extensive appendixes of useful data are included.

PRINCIPLES OF INDUSTRIAL WASTE TREATMENT. By C. Fred Gurnham. 1955, John Wiley & Sons, Inc., New York, N. Y. 399 p., $9\frac{1}{4} \times 6$ in., bound. $9.50. The greater part of this book for practicing engineers and students is a discussion of operations and processes used to treat wastes before discharging them into natural streams or municipal sewers: Sedimentation, filtration, heat-transfer operations, and various chemical and biological treatments. Pollutional effects and criteria for evaluating pollution are also discussed, and the last chapter gives brief descriptions of some process industries that have major disposal problems.

PRINCIPLES OF NUCLEAR REACTOR ENGINEERING. By Samuel Glasstone. D. Van Nostrand Company, Inc., New York, N. Y., 1955. 861 p., $9\frac{1}{4} \times 6\frac{1}{4}$ in., bound. $7.95. This is a broad, over-all review of fundamental scientific principles prepared for engineers who wish to know something of the impact of nuclear energy on their professional activities. It may also serve as a text for senior and graduate students. The separate chapters cover essentials of nuclear physics, reactor theory, instrumentation and control, fuels and materials, and various associated problems of reactor design. A number of existing reactors are briefly described in the last chapter.

PROBLEMS AND CONTROL OF AIR POLLUTION. Proceedings of the First International Congress on Air Pollution. Edited by Frederick S. Mallette. Reinhold Publishing Corporation, New York, N. Y., 1955. 272 p., $9\frac{1}{4} \times 6\frac{1}{4}$ in., bound. $7.50. These proceedings papers, presented by experts from seven countries, provide new and authoritative information on a wide range of subjects of interest to engineers, municipal officials, management, and others concerned with reducing or eliminating air contamination. Two papers review the British smog problem and public-relations aspects of air-pollution control; the remaining twenty-three cover specific topics relating to gaps in available knowledge, current research findings, the treatment and recovery of sulphur dioxide, and experiences abroad. Bibliographies accompany many of the papers.

PROCEEDINGS OF THE AMERICAN POWER CONFERENCE. Volume 17, 1955. Illinois Institute of Technology, Technology Center, Chicago, Ill., 1955. 722 p., $9\frac{1}{4} \times 6$ in., bound. $6. As in previous years the papers in these proceedings emphasize the practical rather than the theoretical view and range from the technical to the economic and social aspects of power generation, transmission, and distributions. Grouped by sessions—general interest, nuclear energy, mechanical, water technology, and electrical—the individual papers deal with such subjects as scientific manpower, sodium-graphite reactor power plants, power-plants stacks under wind loading, small gas turbines, the St. Lawrence Seaway, computing devices, and many others.

PROFESSIONAL ENGINEERS' INCOME AND SALARY SURVEY 1954–1955. National Society of Professional Engineers, Washington, D. C. 43 p., 9×6 in., paper. $1.00 (N.S.-P.E. members $0.50). The information in this second biennial survey is based upon over 14,000 questionnaires returned by members of the Society. Data is given on the geographic distribution, type of employment, branch of engineering, and kind of work done by this group of engineers, and on the salaries they earned. The 1954 statistics are compared with the findings of two years previous.

PROFESSIONAL DEVELOPMENT—THE RESPONSIBILITY OF INDUSTRY AND THE ENGINEER, CONFERENCE PROCEEDINGS. National Society of Professional Engineers, Washington 5, D. C., 1955. 56 p., $9\frac{1}{2} \times 6\frac{3}{4}$ in., paper. $4. (N.S.P.E. members $2.) These proceedings contain five papers dealing with industry's responsibilities to the engineer, the development and utilization of engineers in industry, the need for engineer-industry co-operation, the engineers' responsibility to industry, and the role of engineering education in engineer-industry co-operation. The transcript of a panel discussion covering various aspects of these topics is also included.

QUANTUM THEORY OF SOLIDS. By R. E. Peierls. Oxford University Press, New York, N. Y., 1955. 229 p., $9\frac{1}{2} \times 6\frac{1}{4}$ in., bound. $4.80. An exposition of fundamental problems, addressed to theoretical physicists and to experimentalists with a working knowledge of quantum mechanics. The topics discussed include crystal lattices, cohesive forces in metals, ferromagnetism, semiconductors and luminescence, and superconductivity. A list of references is appended.

REIBSCHEIBEN-REGELGETRIEBE. (Schriftenreihe Antriebstechnik, no. 4.) By W. Thomas. Friedr. Vieweg & Sohn, Braunschweig, Germany, 1954. 79 p., 76 p., $9\frac{1}{4} \times 6\frac{3}{4}$ in., boards. 19.80 DM. A mathematical analysis of the friction-disk variable-speed transmission, including a discussion of the effects of using various materials. A separate section, in a pocket in the back cover, contains some 76 pages of pertinent sketches, graphs, and tables.

RIEMENTRIEBE KETTENTRIEBE KUPPLUNGEN. (Schriftenreihe Antriebstechnik, no. 12.) Friedr. Vieweg & Sohn, Braunschweig, Germany, 1954. 250 p., $8\frac{3}{8} \times 6$ in., bound. 24.50 DM. The sixteen papers in this compilation deal with various design and operational aspects of belts and belt drives, chain drives, and several types of mechanical couplings. The specialized treatments include considerable technical detail.

TABLES OF THE CUMULATIVE BINOMIAL PROBABILITY DISTRIBUTION. (Annals of the Computation Laboratory, volume 35.) Harvard University Press, Cambridge, Mass., 1955. 503 p., $10\frac{3}{4} \times 8$ in., bound. $8. This volume greatly extends the range of tabulation of the mathematical function which represents the probability that at least r successes will occur in a given number of trials. The introduction gives the mathematical background, describes interpolation methods, and discusses seventeen applications—for example, in sampling and quality-control work.

ASME Boiler and Pressure Vessel Code

Interpretations

THE Boiler and Pressure Vessel Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure: (1) Inquiries are submitted by letter to the Secretary of the Boiler and Pressure Vessel Committee, ASME, 29 West 39th Street, New York 18, N.Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in MECHANICAL ENGINEERING.

(The following Case Interpretations were formulated at the Committee meeting September 16, 1955, and approved by the Board on November 15, 1955.)

Case No. 1122-4 (Reopened)
(Special Ruling)

Add the following stress values:

ALLOY MATERIAL	SPECIFIED MIN. TENSILE	850
Type 316 (TS)*	70,000	12,250
Type 316 (YS)	70,000	8500

Case No. 1134-2 (Reopened)
(Special Ruling)

In the Inquiry, revise the upper limit on manganese from "0.90" to "1.00" per cent.

In the Reply, first paragraph, revise the upper temperature limit from "150 F" to "200 F."

Case No. 1204-1 (Reopened)
(Special Ruling)

Inquiry: Is it permissible in welded construction conforming to the requirements of Section VIII of the Code to use quenched and tempered steel plate and forgings conforming to the requirements of the following specification?

(1) *Scope* This specification covers alloy-steel plates of firebox quality and alloy-steel forgings intended particularly for use in welded pressure vessels.

(2) *General Conditions for Delivery* Material furnished under this specification shall conform to the applicable requirements of the current edition of the Tentative Specification for General Requirements for Delivery of Rolled Steel Plates of Flange and Firebox Qualities (ASTM Designation: A20), except as herein modified.

(3) *Process* The steel shall be made by either or both of the following processes: open-hearth or electric-furnace.

(4) *Heat Treatment* The material shall be treated by the material manufacturer to produce the tensile requirements of Table 2 by heating to not less than 1650 F, quenching in water between 50 and 100 F, and tempering to not less than 1150 F with a holding time of one hour per inch of thickness, but in no case less than one-half hour.

(5) *Chemical Composition* The steel shall conform to the chemical requirements prescribed in Table 1.

If the material is subjected to check analysis, the AISI standard permissible variations apply.

(6) *Tensile Properties* The material as represented by the tension test specimens shall conform to the requirements as to tensile properties prescribed in Table 2.

(7) *Bending Properties* The bend test specimen shall stand being bent cold (room temperature) through 180 deg without cracking on the outside of the bent portion to an inside diameter which shall have the relation to the thickness of the specimen prescribed in Table 3. When the test is made on a specimen reduced in thickness, the rolled surface shall be on the outer curve of the bend.

Table 1 Chemical Requirements

	PER CENT
Carbon	0.10/0.20
Manganese	0.60/1.00
Phosphorus, max.	0.035
Sulfur, max.	0.040
Silicon	0.15/0.35
Nickel	0.70/1.00
Chromium	0.40/0.80
Molybdenum	0.40/0.60
Vanadium	0.03/0.10
Copper	0.15/0.50
Boron	0.002/0.006

Table 2 Tensile Requirements

Tensile strength, psi, min.	105,000
Yield strength, psi, min.	90,000
Elongation in 2 in., min., per cent	17

Table 3 Bend Diameters

Thickness of Material	Ratio of Bend Diameter to Thickness of Specimen
1/2 to 1 in., incl.	2
Over 1 to 2 in., incl.	3

(8) *Test Specimens* The test specimens shall be prepared from the material in its heat-treated condition, or from full thickness samples similarly and simultaneously treated.

(9) *Number of Tests for Plate* One tension test longitudinal from the bottom, one tension test longitudinal from the top, and one bend test transverse from the top shall be made from each plate as heat-treated. One homogeneity test shall be made from each plate as rolled.

Note: The term "plate as rolled" used here refers to the unit plate rolled from a slab or directly from an ingot in its relation to the location and number of specimens, not to its condition.

(10) *Number of Tests for Forgings and Formed Parts* One tension and one bend specimen shall be made of each heat of material included in any one heat-treatment lot.

Reply: It is the opinion of the Committee that the material specified in the Inquiry may be used in the construction of welded pressure vessels under the rules of Section VIII of the Code provided the following additional requirements are complied with:

(1) The maximum thickness of shell and head plates shall be 2 in.

(2) The maximum operating temperature shall not exceed 650 F.

(3) The requirements of Par. UG-84 shall be met for vessels that are to operate at temperatures below —20 F.

(4) The maximum allowable stress value shall be 26,250 psi.

(5) Shell plates shall not be heated for forming to a temperature higher than 1100 F. Other parts including heads that are heated for forming to temperatures over 1100 F shall be heat-treated by the manufacturer of the head or part. Forgings shall be heat-treated by the manufacturer of the forging. Test specimens prepared from full-thickness material in its final heat-treated condition, or from full-thickness samples similarly and simultaneously treated, shall be taken from any pressure parts that have been heat-treated above 1100 F after forming.

(6) When the shell or head thickness exceeds 0.50 in., the finished vessel shall be stress-relieved as provided in Par. UCS-56(c). The stress-relieving temperature shall be between 1000 F and 1100 F (at least 50 F below the minimum tempering temperature).

CAUTIONARY NOTE: Filler metal deposited by nickel-molybdenum-vanadium

type of electrodes can become embrittled at the above stress-relieving temperature.

(7) Double welded butt-joints or their equivalent shall be examined radiographically for their full length as prescribed in Par. UW-51.

(8) Welds not fully radiographed, including welds for attaching non-pressure parts, shall be examined after the hydrostatic test by the magnetic-particle method.

(9) The qualification of the welding procedure and the welders shall conform to the requirements of Section IX, except that the radius of the mandrel used in the guided bend tests may be $1^1/_4$ in. instead of $^3/_4$ in. A separate welding procedure shall be made for this material.

(10) All main welded joints including welds for nozzle attachment shall be of the double welded butt type or their equivalent. Where a backing strip is used, it shall be removed and the joint shall be examined by the magnetic particle method prior to the required full radiographing.

(11) All parts shall be made of the material specified in the Inquiry except that flanges of other materials may be welded to nozzle necks provided that the welds are located outside the limits of reinforcement as prescribed in Par. UG-40(c).

(12) Structural attachments of other steels shall not be welded directly to shells or heads of material specified in the Inquiry.

Case No. 1208

(*Special Ruling*)

Inquiry: May alloy steel tubing of the following chemical composition be used in economizers under rules of Section I?

CHEMICAL COMPOSITION	PER CENT
Carbon, max.	0.12
Manganese	0.20 to 0.50
Phosphorus	0.06 to 0.15
Sulfur, max.	0.05
Silicon	0.10 to 0.75
Copper	0.25 to 0.70
Chromium	0.30 to 1.25
Nickel	0.25 to 0.75

All other requirements will comply with Specification SA-210.

Reply: It is the opinion of the Committee that tubing of the chemistry listed in the Inquiry can be used in economizers under Code rules provided that all other requirements of Specification SA-210 are met. The minimum tensile strength shall be 60,000 psi with allowable stresses not to exceed 15,000 psi for temperatures up to 650 F.

For welded construction, the material shall be qualified separately under Section IX for Procedure Qualification.

Case No. 1209

(*Special Ruling*)

Inquiry: May integrally finned tubes made from copper and copper alloy tubing conforming to SB-111 and SB-75 be used in ASME Code construction?

Reply: It is the opinion of the Committee that integrally finned tubing made from copper and copper alloys conforming to SB-111 and SB-75 may be used in Code construction under the following conditions:

(1) The grain size requirements of the above specifications are replaced by minimum tensile and minimum yield strength values determined in accordance with ASTM E-8 par. 13 as follows:

ALLOY	CONDITION	MIN. T.S.	MIN. Y.S.
Muntz Metal	Annealed	50,000	20,000
Admiralty Metal	Annealed	45,000	15,000
Red Brass	Annealed	40,000	12,000
Aluminum Brass	Annealed	50,000	20,000
Aluminum Bronze	Annealed	50,000	20,000
70/30 Cu-Ni	Annealed	55,000	20,000
80/20 Cu-Ni	Annealed	50,000	18,000
90/10 Cu-Ni	Annealed	40,000	15,000
Copper	Annealed	30,000	10,000
Copper	Light Drawn	36,000	30,000
Copper	Hard Drawn	45,000	40,000

For all tubing in the annealed condition, the qualifying tensile tests may be performed on tubing prior to the finning operation. For copper in the harder tempers, the qualifying tensile tests must be performed on tubing which has been finned and from which the fins have been removed by machining.

(2) The applicable design stresses for the copper alloys are those shown in Table UNF-23 for those alloys. For copper, the design stresses shown for SB-75, Annealed Seamless Tubing, in Table UNF-23 must be used, unless only the finned sections are exposed to pressure and unless the physical properties as developed by the test of the machined tube equal or exceed the minimum specified values listed in Table UNF-23 for SB-111 condenser tubing in light drawn or hard drawn condition, in which case the appropriately higher design stresses may be used.

(3) The allowable pressure, internal or external, must be based on the minimum wall of the finned tube.

(4) Each tube shall withstand, without evidence of leakage, an internal air pressure of 250 psi minimum for 5 seconds while the finned tube is immersed in water or other suitable liquid.

Proposed Revisions and Addenda to Boiler and Pressure Vessel Code...

As NEED arises, the Boiler and Pressure Vessel Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism. If and as finally approved by the ASME Board on Codes and Standards, and formally adopted by the Council, they are printed in the annual addenda supplements to the Code. Triennially the addenda are incorporated into a new edition of the Code.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler and Pressure Vessel Committee, ASME, 29 West 39th Street, New York 18, N. Y.

Power Boilers 1952

PAR. P-115(b) Re-letter as Par. P-115(d) and add the following as new subparagraphs (b) and (c):

(b) Fire tube boilers may be constructed by attaching an unflanged tube sheet to the shell by welding provided that:

(1) The tube sheet is supported by tubes, or braces, or both;

(2) The welded joint is wholly within the shell or wrapper sheet and forms no part thereof;

(3) The weld is a full penetration weld, of at least the full thickness of the tube sheet, applied from either or both sides;

(4) The shell or wrapper sheet, where exposed to primary furnace gases and not water cooled, does not extend more than $^1/_8$ in. beyond the outside face of the tube sheet;

(5) The weld attaching a furnace or lower tube sheet of a vertical fire tube boiler to the furnace sheet is wholly within the furnace sheet and ground flush with the upper or water side of the tube sheet;

(6) The qualification tests of procedure and of welding operators is as required in Section IX of the Code;

(7) The construction conforms in all other respects to Code requirements including welding, stress relieving, etc., except radiographing is not required;

(8) This construction shall not be used on the rear head of a horizontal return tubular boiler.

(c) Throat sheets, inside and outside front furnace sheets when fully stayed may be attached as required in the foregoing subparagraph (b) (1) to (8).

PAR. P-214 Revise to read:

P-214 *Areas of Heads to be Stayed* The area of a segment of a flanged head to be stayed shall be the area enclosed by lines drawn 2 in. from the tubes and a distance *d* from the shell as

shown in Figs. P-25 and P-26. The value of d used may be the larger of the following values:

d = The outer radius of the flange, not exceeding 8 times the thickness of the head, (1)

$$d = \frac{5T}{\sqrt{P}}$$

where d = unstayed distance from shell, inches,
T = thickness of head in sixteenths of an inch,
P = maximum allowable working pressure, pounds per square inch.

The area of a segment of an unflanged head to be stayed shall be the area enclosed by the shell and a line drawn 2 in. from the tubes.

In water-tube boilers, the tubes of which are connected to drum heads, the area to be stayed shall be taken as the total area of the head less the area of an annular ring of width d measured from the inner circumference of the drum shell.

The rules in Par. P-216 shall be used to determine if staying is required.

Par. P-217 In the first and second lines, change "segment of a head" to read "segment of a flanged head."

Add the following at end of paragraph:

The net area to be stayed in a segment of an unflanged head may be determined by the following formula:

$$\frac{4\,(H-2)^2}{3}\sqrt{\frac{2R}{(H-2)}-0.608}$$

Material Specifications, 1952

The Boiler and Pressure Vessel Committee has approved adding to Section II the following revisions to specifications:

Ferritic Plates	Welding
SA-7-55T	SA-233-55T
SA-387-55T	SA-298-55T
	SA-316-54T
Ferritic Castings & Forgings	
SA-31-55	SA-320-55T
SA-105-55T	SA-325-55T
SA-181-55T	SA-352-55T
SA-182-55T	SA-354-55T
SA-193-55T	SA-336-55T
SA-266-55	
SA-306-55T	
SA-307-55T	
Ferritic Tubular Products	
SA-53-55T	SA-213-55T
SA-83-55T	SA-214-55T
SA-106-55T	SA-226-55T
SA-135-55T	SA-250-55T
SA-178-55T	SA-333-55T
SA-179-55T	SA-334-55T
SA-192-55T	SA-335-55T
SA-199-55T	SA-369-55T
SA-209-55T	
SA-210-55T	
Stainless Steel	
SA-194-55T	SA-312-55T
SA-249-55T	SA-376-55T
SA-268-55	

Note: Specifications SA-179, SA-199, SA-214 and SA-387 are newly adopted.

Nonferrous Materials

SB-11-55

SB-12-55

SB-13-55, except: Under Section 6, third line of Note, add "psi" after 9000. Fourth line of Note, delete sentence: "The tension test shall be required only when definitely specified in the purchase order."

SB-42-55, except: Section 5 under Note, delete sentence "The tension test shall be required only when definitely specified in the purchase order."

SB-43-55, except: Section 5, under Note, delete sentence "The tension test shall be required only when definitely specified in the purchase order."

SB-75-55, except: Section 6(a), under Note, delete sentence "The tension test shall be required only when definitely specified in the purchase order." In addition, change the table under that note as follows:

Delete the word "min." from the heading "Tensile Strength, Min., Psi."

Add the word "min." after the 30,000 and 45,000 values given in the tabulation.

Insert "light drawn" tensile strength as "36,000 to 47,000."

SB-96-55

SB-98-55

SB-111-55, except: Section 4, under Note, delete sentence "The tension test shall be required only when definitely specified in the purchase order."

SB-152-55

SB-169-55

SB-171-55, except: Table I, change the nickel to read "9.0 to 11.0."

Under the Table V reference the last word should read "alloys."

The Boiler and Pressure Vessel Committee has approved the deletion from Section II of SA-271, Specification for Seamless Austenitic Chrome Nickel Steel Still Tubes for Refinery Service.

Unfired Pressure Vessels, 1952

Preamble Revise the first sentence of the third paragraph to read: "The 1952 and 1956 Editions contain parts not completed for inclusion in the interim edition."

Revise the fourth paragraph to read:

Code Cases which apply to the 1949 Edition have been annulled. It is the intent of the Boiler & Pressure Vessel Committee that vessels built after January 1, 1957, in accordance with the 1949 and earlier editions should not be marked with the Code symbol.

Table UNF-23 Add the accompanying stress values.

Par. UCI-35(b)(3) Add the following to the last sentence: ". . . using the allowable stress values in bending."

Par. UA-50(a) Revise lines 5 and 6 to read: Longitudinal hub stress S_H not greater than S_f for cast iron and 1.5 S_f for materials other than cast iron.

Announcement

The Boiler and Pressure Vessel Committee has adopted ASA B16.5-1953, American Standard Steel Pipe Flanges and Flanged Fittings, as acceptable for use in construction of Unfired Pressure Vessels, Section VIII of the Boiler and Pressure Vessel Code.

Stress Values for Table UNF-23

Mat'l & Spec No.	Condition	Specified Tensile Strength Psi	Minimum Yield Strength Psi	Maximum Allowable Stress Values, Psi, Tension, for Metal Temperature Not Exceeding Deg F												
				100	150	200	250	300	350	400	450	500	550	600	650	700
Copper																
SB-13 Seamless Boiler Tube	Annealed	30000	9000	6000	6000	5900	5800	5000	3800	2500	...	...	...	...	...	...
SB-42 Pipe	Annealed	30000	9000	6000	6000	5900	5800	5000	3800	2500	...	...	...	...	...	...
SB-75 Seamless Tube	Annealed	30000	9000	6000	6000	5900	5800	5000	3800	2500	...	...	...	...	...	...
Aluminum Brass																
SB-111 Seamless Condenser Tube	Annealed	50000	18000	12000	12000	12000	12000	12000	7500	3000	2000	...	...	...	...	...
Aluminum Bronze																
SB-111 Seamless Condenser Tube	Annealed	50000	19000	12500	12400	12200	11900	11600	10000	6000	4000	2000	...	...	...	...
Copper-Nickel, 80-20																
SB-111 Seamless Condenser Tube	Annealed	45000	16000	10700	10600	10500	10400	10300	10100	9900	9600	9300	8900	8400	7700	7000
Copper-Nickel, 70-30																
SB-111 Seamless Condenser Tube	Annealed	52000	18000	12000	11600	11300	11000	10800	10600	10300	10100	9900	9800	9600	9500	9400

ASME News

With Notes on the Engineering Profession

E. S. Newman, *News Editor*

Grand Banquet of World Symposium on Applied Solar Energy was attended by nearly 1000 people who heard John Jay Hopkins, chairman and president, General Dynamics Corporation, speak on world-energy community. Robert C. Swain, vice-president, American Cyanamid Company, presided. Banquet was held in Thunderbird Room of Hotel Westward Ho, Phoenix, Ariz., where symposium ran from November 1 to 5. General chairman of the conference was Lewis W. Douglas, chairman of the board, Southern Arizona Bank and Trust Company. Mr. Douglas was United States Ambassador to Great Britain from 1947 to 1950. A Solar Engineering Exhibit, comprising 94 exhibits, showed "The Sun at Work."

World Symposium on Solar Energy Held in Arizona Hailed by Scientists[1]

900 Scientists and Industrialists From 34 Countries, in Six Continents, Attended

The increasing dependence of civilization on adequate supplies of energy and the progressive reduction of our energy resources in the form of fossilized fuels has again focused attention on the availability of suitable alternatives, by means of which we can live (in part at least) on our income rather than on our rapidly diminishing capital. An obvious source of energy supply is solar radiation, which is estimated, roughly, to amount to 1 calorie per minute per square centimeter of the earth's surface. This is a very approximate and average figure but it does indicate that, if properly applied, most, if not all, of our energy requirements could be met from this source.

Unfortunately, however, in most parts of the world the receiving temperature is too low to enable solar energy to be used economically for large-scale operations. Nevertheless, there are some applications and some localities where the sun's heat can be employed with advantage. This, then, was the reason for the various conferences that have been held within the past few years to discuss various applications of solar energy and to stimulate additional research work in that field.

Association of Applied Solar Energy

It is not surprising that the first co-ordinated effort on a large scale should have started in the sunny and somewhat arid state of Arizona, with the formation on March 17, 1954, of the Association of Applied Solar Energy. This Association, together with Stanford Research Institute and the University of Arizona, sponsored the first World Symposium on Applied Solar Energy, which took place between Oct. 31 and Nov. 5, 1955, and was attended by more than 900 scientists and industrialists from 34 different countries, located in six continents.

The list of participants was impressive, as practically all of the principal research workers in the solar-energy field were present and most of them took part in the discussions. The general chairman was the Hon. Lewis W. Douglas, former U. S. Ambassador to Great

[1] Report by E. A. Allcut, Professor of Mechanical Engineering, University of Toronto, Toronto, Ont., Can. Fellow ASME.

Photographs supplied by Stanford Research Institute, Menlo Park, Calif.

Britain and prominent industrialist. Financial support from the National Academy of Science, the National Science Foundation, the Ford Foundation, the Office of Naval Research, the United States Air Force, and UNESCO made the meeting possible and indicated the general appreciation of the potential importance of this source of energy.

The proceedings were generally in English but were translated simultaneously into three other languages. Approximately 117 papers were read during the week and there were also numerous informal discussions.

Solar Energy Conference—the Scientific Basis

The Scientific Basis of the Use of Solar Energy was discussed during the first two days at the University of Arizona, Tucson, and here most of the groundwork was laid, as 94 papers were read and debated in three different sections, which met simultaneously. Section A (44 papers) was concerned with Thermal Processes, notably the collection of solar radiation by means of flat plates or focusing collectors. The former are used mostly for house heating, hot-water supplies, distillation of salt water, and other similar operations in which working temperatures are comparatively low. The latter are employed for cooking, for the attainment of localized high temperatures (up to 4000 C) and potentially for thermal engines of various kinds. Section B (20 papers) considered photochemical processes, such as the growth and yields of algae, the use of food plants, and other photochemical means for the convenient storage of solar energy. Section C (14 papers) dealt with the direct transformation of solar radiation into electrical energy by thermoelectric means and various kinds of battery. The basis of all these conversion devices is the amount and kind of solar radiation that is received in different parts of the world and therefore the various methods of measuring these quantities were described by astronomers and meteorologists from America, Europe, and South Africa, respectively.

World Symposium on Applied Solar Energy

The center of activity was then transferred to Phoenix, where the World Symposium was introduced by three papers which were of a general nature, and described respectively the formation and functions of the Association, the various ways in which the radiant energy might be usefully employed, and the economics of the various processes concerned. There followed a series of 23 papers and panel discussions, at which detailed applications were considered. The ground covered during these meetings was much the same as that traversed in Tucson and so there was a good deal of repetition in the material presented by the various speakers. In fact, it is difficult to understand why the two conferences were not merged into one or, alternatively, why they did not deal, respectively, with two different aspects of the subject.

Solar Engineering Exhibit

The high light of the Phoenix conference was probably the Solar Engineering Exhibit which consisted of a number of demonstrations showing "The Sun at Work." The exhibition was held out of doors and was beautifully organized. It was divided into ten sections comprising 94 exhibits, of which a large proportion were working models. There were nine engines and pumps, eight water stills, and nineteen heat collectors of the flat and focusing types. Also included were eight portable cookers and seven high-temperature furnaces, one of which was built from a converted 60-in. searchlight mirror. Water and house heating were illustrated by drawings, photographs, and models. Among the most interesting of the exhibits were the photovoltaic converters or solar batteries, of which six were shown. In the exhibition they were used to operate small motors and clocks and for communication purposes. Models and display panels were used to illustrate the growth of algae and the use of reflectors to warm the soil, to concentrate sunlight on growing crops, and generally to assist agricultural processes. Altogether, the exhibit was comprehensive and impressive and from it one gathered the impression that the first practical applications of solar energy were likely to be for heating purposes rather than for power generation. At the time of our visit the exhibit was thronged with school children and their teachers. This was particularly appropriate, as the next generation may possibly be vitally concerned with these matters.

The work of numerous individuals and research groups was shown at the exhibit, including contributions from the Massachusetts Institute of Technology research program led by Hoyt C. Hottel, Mem. ASME. Material also had been made available by the University of Wisconsin research group headed by Farrington Daniels. Also included in the exhibit was a series of eight dioramas depicting scenes of solar utilization in fancy and fact from the past and the future.

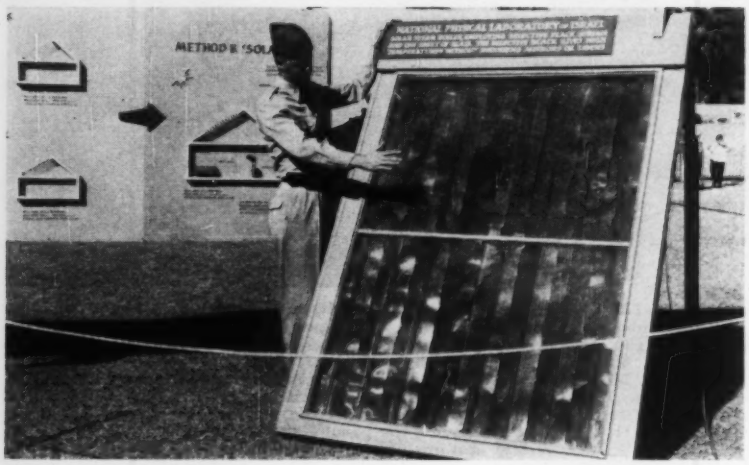
Final session of World Symposium on Applied Solar Energy held in Phoenix, Ariz., Nov. 1–5, 1955, was a round-table discussion on "The Future of Applied Solar Energy," participated in by members on the floor as well as the panel. Members of the panel include, *left to right,* John Yellott, Mem. ASME, assistant director, Stanford Research Institute, Phoenix, Ariz.; Farrington Daniels, University of Wisconsin; Guillermo Zuloaga, Creole Petroleum Corporation, Venezuela; H. C. Hottel, Mem. ASME, the Massachusetts Institute of Technology; Jack Myers, University of Texas; Irving Wolff, vice-president of research, Radio Corporation of America Laboratories; G. Dupouy, director, Centre National de la Recherche Scientifique, Paris, France; Guy Benveniste, Mem. ASME, Stanford Research Institute research economist who interpreted in English Dr. Dupouy's remarks made in French; Henry B. Sargent, president, American and Foreign Power Company, who moderated the panel discussions, at which detailed solar-energy applications were considered.

Cub Scout Troop of Tempe, Ariz., hears an explanation of the possible uses of solar energy. This display was prepared by the University of Arizona, Tucson.

Devices to Harness the Sun's Power . . .

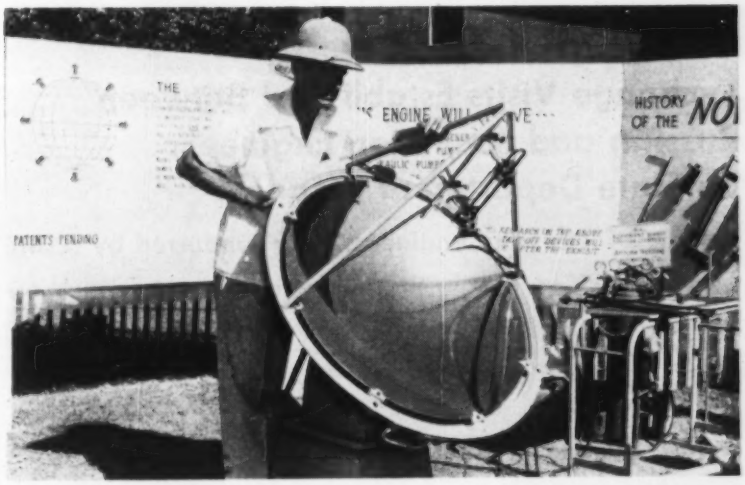
. . .Shown at Solar Engineering Exhibit, Phoenix, Ariz.

At *right* one sees a model of the 35-ft furnace exhibited by the Centre National de la Recherche Scientifique, Paris, France. It is an exact scale model of the solar furnace built by Dr. Felix Trombe in the old fort of Mont Louis, French Pyrenees. The parabolic reflecting surface consists of 3500 small curved mirrors.



Selective-surface collectors developed and exhibited by H. Tabor, National Physical Laboratory of Israel, Jerusalem, demonstrated that a higher equilibrium temperature can be reached with this device. A selective-surface collector absorbs sunlight readily but does not reradiate heat easily. Lieut. Clyde Edwards, *left*, Luke AFB, tests the intensity of radiated heat.

Gregorian Astronomical Telescope, displayed to illustrate the similarity between astronomical devices and high-temperature solar-energy collecting devices, was inspected by Sister Mary Joachim and Sister Ann Timothy of Most Holy Trinity Convent, Sisters of Notre Dame de Namur, Sunnyslope, Ariz. The telescope was designed, constructed, and exhibited by William A. Rhodes of QUEST Lab, Phoenix. Paraboloid reflectors and clock-operated tracking devices similar to those used in telescopes can be used in collecting solar radiation.



Novoid engine, *right,* produces rapid pulsating mechanical energy directly from any source of heat (a solar collector in this case). The engine itself has only one moving part—a column of fluid, the heated end of which alternately explodes into high-pressure steam, then condenses again, producing a hydraulic thrust at the other end of the engine.

Somor 1½-hp engine, largest device exhibited, is sun-operated. Sulphur dioxide is vaporized in the flat-plate collector, which operates in a closed cycle. The generator is used to generate electricity, or the engine can drive a water pump or any other mechanical load. Somor, manufactured by Societa Motori Recuperi of Lecco, Italy, is shown pumping a steady stream of water from underground.

Vladimire P. Loukine, *left*, and Georgi P. Kazanski, *center*, examine a copy of "Mechanical Catalog" with ASME President Joseph W. Barker, *right*, before the press conference which was held at ASME Headquarters, Nov. 29, 1955

Exchange Visits Established Between Russian and American Engineers by State Department Proposal

Russian engineers' tour conducted by ASME

As the result of a proposal by the State Department to The American Society of Mechanical Engineers, two Russian engineers visited in the United States where they inspected plants and viewed various exhibitions, from November 14 to 30.

The Russian experts, Vladimire P. Loukine, Machine Construction Ministry, specializes in instruments for automation, and Georgi P. Kazanski, Collegium Radio-Technical Ministry, specializes in electronics. Both men are from Moscow.

Brig. Gen. Stewart E. Reimel, U.S.A. (ret.), consultant to ASME, conducted the two-week tour at the request of the State Department. The trip was initiated in a proposal to C. E. Davies, secretary ASME, by Robert Murphy, Deputy Undersecretary of State.

Referring to the Foreign Ministers Conference in Geneva, Mr. Murphy wrote that one of the more important topics considered at the Conference was that of increased contacts between the East and West in the cultural and scientific fields. To this end several exchange visits have already taken place between the USSR and the United States, in the fields of agriculture, housing, and journalism.

ASME Participation Invited

"It has been decided to ask the assistance of your organization because of the unique and outstanding position of The American Society of Mechanical Engineers in the field of automation and because of the Society's contacts with firms in this field," Mr. Murphy wrote.

It was in this proposal that Mr. Murphy said American engineers will be extended the opportunity of visiting plants in the USSR.

Also traveling with the Russian visitors were Vladimir Dudenkov, attaché of the Russian Embassy in Washington, D. C., and Alexander Logofet of the U. S. State Department. Both men acted as interpreters.

Chicago Press Conference

On November 15, during the ASME Diamond Jubilee Annual Meeting, the first press conference was held. Reporters from the leading Chicago daily newspapers asked questions of the Russians ranging from automation to education and television.

They were asked about their impression of the International Automation Show and the R. R. Donnelley & Sons Company plant. These questions brought forth the information that USSR's advancement in this field was parallel to that of America's. They were asked if organized labor in the Soviet Union opposed automation. They replied no; quite to the contrary, in their country labor favored automation. Questions referring to "length of average work week in Russia" were parried. Further questioning revealed that there are 12 TV broadcasting stations in so many different cities throughout USSR and that there are between four and five-million TV receivers; furthermore, from their observation, the TV receivers were less expensive in the USSR than here in the United States or in West Germany. The TV programs are of an educational nature; however, recently there have been some gardening programs and a fashion show.

There followed a series of questions on education. They stated that Russian students sought technical education of their own volition rather than by other influences. It was further stated that 50 to 60 per cent of university-trained students in Soviet Russia study technical subjects—technical studies included physics, chemistry, medicine, psychology as well as engineering and general scientific subjects. Establishing the fact that women are extremely welcome to study in the "technical" school, it was not possible to get an answer to the question, "What is the number of women engaged in engineering work?" or "How many women in Russia are employed in responsible charge of an engineering project?"

Before the Russians left for home another press conference was held at ASME Headquarters in New York City on November 29.

President Barker Names U. S. Mission to USSR

ASME President Joseph W. Barker introduced the Russian experts to the New York newspapermen and made the following announcement:

"It now gives me great pleasure on behalf of the State Department, to announce that a return visit to Russia has been arranged for a team made up of three members of this Society: Nevin L. Bean of the Automatic Transmission Division of the Ford Motor Company; Weldon H. Brandt, engineering manager of the Westinghouse Electric Corporation, East Pittsburgh, Pa.; and Albert C. Hall, general manager of research at the Bendix Corporation in Detroit, Mich. This team will leave for Moscow on Sunday, December 4th, and will return just before Christmas, visiting a number of plants in the Soviet Union in the field of automation."

Questions on the use of computers in Russia opened the interview. The Russians revealed that computers are used extensively in various phases of engineering research and vital statistics. While they would not estimate the number of electronic "brains" in use, they said there were "many."

Asked what had been the most interesting thing they saw, Mr. Loukine replied: "The most interesting thing is that we did not see what we wanted to see." Exonerating the Society of any blame for this—they expressed praise for all ASME had done for them during their visit. They had hoped to see advanced American automation systems actually at work in factories and to discuss these techniques with United States engineers. In the course of the discussions they stressed that the Russians were for sensible, economic automation... if manual labor can do the job as efficiently and economically, principles of automation were not applied in such an operation. Both the Soviet engineers warned against exaggerating the possibilities of automation. Regarding the electronics industry they said there had been a fivefold increase in the production of television sets from 1950 to 1955. The initial figure was not revealed.

ASME Boiler and Pressure Vessel Committee Policy on Nuclear Installations

RECOGNIZING that nuclear installations now under construction, or contemplated, are not adequately covered by the ASME Boiler and Pressure Vessel Code in its present form, and that there will be an increasing number of such installations in the future, the ASME Boiler and Pressure Vessel Committee has instituted a Special Committee on Nuclear Power.

This Special Committee includes representation from the ASME Boiler and Pressure Vessel Committee, from fabricators and users of nuclear equipment, and from the United States Atomic Energy Commission. It will function as a part of the ASME Boiler and Pressure Vessel Committee under the same procedures now in effect for boilers and pressure vessels.

The Special Committee will in no way attempt to cover hazards to health due to nuclear radiation. Responsibility for safe performance of the reactor beyond the aspects of pressure-vessel design, fabrication, and inspection is outside the scope of the Special Committee. Such matters are the responsibility of the United States Atomic Energy Commission.

The ASME Boiler and Pressure Vessel Committee will assist inquirers to the fullest possible extent on steam generators, vessels, and pressure parts thereof for use in nuclear installations, on questions relating to Code materials and methods of construction. Where present Code provisions are not adequate, or where it is desired to use materials or methods of construction not included in the ASME Boiler and Pressure Vessel Code, the inquirer should submit complete information on the proposed material or construction for consideration by the Committee.

Such inquiries should be directed to the Secretary, ASME Boiler and Pressure Vessel Committee, 29 West 39th Street, New York 18, N. Y.

1956 ASME Spring Meeting to Be Held in Portland, Ore.

PLANS for the 1956 Spring Meeting of The American Society of Mechanical Engineers to be held in Portland, Ore., March 18–21, at the Multnomah Hotel, are well under way. The theme of the meeting will evolve around the wood industries, as several sessions have been planned on subjects of processing, waste utilization, pulp and paper, fabrication, and material handling of wood and wood products.

Other sessions planned for presentation at the Spring Meeting include the general subjects of: Material handling in airplane manufacture, power, nuclear engineering, fuels, gas turbines, and metal processing.

In addition to the technical sessions to be presented, some interesting field trips are being planned. Among the trips being considered are the Crown Zellerbach Corporation at Camas, one of the largest paper mills in the United States; the Weyerhaeuser Timber Company at Longview, the most integrated mill in the Northwest; the Electric Steel Company of Portland; Techtronics of Portland; the Bonneville Dam near Portland; and a sightseeing trip to Mt. Hood, Timberline Lodge.

The President's Luncheon will be held at noon on Monday, March 19, and the Banquet the evening of Tuesday, March 20. A women's program is being planned to include various sight-seeing tours of Portland as well as a tea and luncheon.

Meetings of Other Societies

Jan. 23–25
Seventh Plant Maintenance and Engineering Conference, Convention Hall, Philadelphia, Pa.

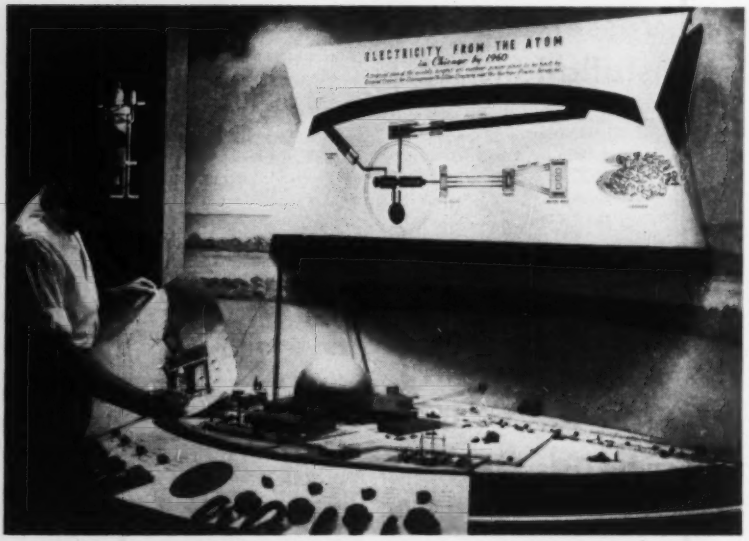
Jan. 23–25
American Society of Heating and Air-Conditioning Engineers, Inc., 62nd annual meeting, Sheraton-Gibson Hotel, Cincinnati, Ohio

Jan. 24–27
American Management Association, general management conference, Hotel Fairmont, San Francisco, Calif.

Jan. 30–Feb. 3
American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York, N. Y.

(ASME Coming Events, see page 111)

View of Portland, Ore., the city where the 1956 ASME Spring Meeting will be held March 18–21, at the Multnomah Hotel. Seen in the background is majestic Mt. Hood. The Willamette River meanders through the heart of the city. The Pacific Ocean is less than two hours away. Beautiful homes and gardens have earned for Portland the name "City of Roses."



This panoramic model of the atomic-power station the General Electric Company will construct 47 miles southwest of Chicago on the Illinois Waterway for the Commonwealth Edison Company was on display at the Chicago Exposition of Power and Mechanical Engineering

Atomic Power Featured in ASME Exposition of Power and Mechanical Engineering

SCIENTIFIC achievement merged with advanced design to lend unique distinction to the Chicago Exposition of Power and Mechanical Engineering. Through its atomic-power section the exposition became the first display of industrial equipment to incorporate nuclear energy among practical and present sources of power and recognize engineering as the agency through which the inherent power of the atom is being brought to everyday use.

The display was held in the Chicago Coliseum, Nov. 14 to 18, 1955, under the auspices of The American Society of Mechanical Engineers, in conjunction with the Society's Diamond Jubilee Annual Meeting at Chicago.

New and improved designs of power-plant and industrial-manufacturing equipment composed the bulk of the exposition, comprising some 225 different product classifications. These included raw and fabricated materials, components and complete units, many auxiliary devices, and mechanical and electrical specialties.

Atomic Power Sections

Scientific interest dominated the atomic-power section. One display showed a model of a medical research reactor intended to explore the possibilities of treating a certain type of brain tumor by radiation.

Engineering interest was focused on reactors, of which a number of different types were revealed. One was a nuclear power plant expressly designed to produce electricity—scheduled to be the first in operation in the United States—exhibited as a scale model by the principal contractor for the Argonne National Laboratory. A boiling-water reactor, the 5000-kw unit, will be placed in operation near Chicago next summer.

A panoramic display of the world's largest all-nuclear power station depicted the layout and operation of the 180,000-kw public utility that is to be completed in 1960 some 50 miles southwest of Chicago on the Illinois Waterway. The equipment contractor for the giant power plant also showed for the first time anywhere its own design for a small boiling-water atomic-power plant in an animated model illustrating the transformation of energy from the atomic to the electrical aspect.

Among other designs depicted at the exposition, the sodium-cooled, graphite-moderated reactor was offered as one of the most promising economical approaches to nuclear-power production. High thermal efficiencies, simplified construction, low-pressure operation, and freedom from chemical reactions between structural parts and fuel and coolants, respectively, were cited as its special advantages.

Three other reactor types were offered in the same display, representing two distinct types. Of these, the pool-type reactor, adapted to experiments requiring maximum neutron flux, uses plate-type assemblies of highly enriched uranium and aluminum alloy, and the entire core is immersed in a pool of high-purity water, which serves at once as a moderator, coolant, and shield—hence the name. This type is the most flexible of all research reactors.

The solution-type reactor has a core consisting of a stainless-steel sphere containing enriched uranium sulphate solution surrounded by a graphite reflector two feet thick, and is cooled by refrigerated distilled water passing through stainless-steel coils within the sphere. Several reactors of this type have been built. An adaptation of the solution type, designed for medical research at a western university, incorporates safety features making it suitable for operation within a densely populated area.

It was disclosed by the engineer-contractor-operator of the AEC Pacific Proving Ground that concrete composed of limonite ore and steel scrap, instead of sand and rock, constitutes an effective radiation shield without special lead lining. This principle is expected to have wide application in construction, ranging from x-ray rooms to the housing of reactors. A further contribution to the safety of industrial atomic plants is the proved possibility of damage control through the incorporation of blast protection in building design. It was also disclosed by the same exhibitor that unpublicized history was made at Eniwetok when a satisfactory concrete was produced using coral aggregate and sea water.

Power Equipment and Auxiliaries

The power section presented displays in the complete range of equipment currently employed by utilities and industrial establishments. On display were exhibits of coal crushers and coal-handling equipment, arches, baffle walls, furnace linings, soot cleaners, dust collectors, and stacks; also displays of package boilers, preheaters, and economizers, condensers and heat exchangers, superheaters, steam traps, and separators; also many power-plant specialties, such as piping, tubing, coils and pipe benders, couplings, flanges, and a variety of valves and controls.

Several exhibits of package boilers indicated possible trends. One exhibitor of high-efficiency, full-automatic units advocated the advantages of multiple-unit batteries of boilers in 18 to 160-hp sizes, for reasons of operating economy and adaptability to power-plant expansion. Others presented new rotary conversion burners in recognition of the growing acceptance of heavy oils. In addition to capitalizing the advantages of burning No. 4 oil—with claimed fuel-cost reduction of 25 to 30 per cent—one showed a 50-hp package boiler requiring less than half the floor space of the same make standard unit of like capacity.

Several exhibits were applicable to large power plants, with wide applications in industry outside the power field. An electrostatic precipitator for smoke prevention in power stations, now shown with the latest improvements in design and application, has been applied in an even greater number of instances in industries where fumes are a health hazard, if not merely a public nuisance. Among such are blast furnaces, carbon-black plants, acid plants, paper mills, and still others where by-product recovery is an important factor.

Among power-plant auxiliaries was an oil purifier of wide application. Permanently installed on a continuous by-pass, it maintains turbine lubricants free from water and foreign matter. In electric plants it is used to remove

moisture and sludge due to oxidation products from insulating oils for transformers, circuit breakers, and oil-immersed switches. In a unit designed for diesel-engine plants a combined centrifugation and filtration process provides for continuous recirculation of the lubricating oil.

Among specialties for the power plant was a steam-purity analyzer for rapid determinations to indicate deficiencies in feedwater treatment, improper plant operation, or even show up condenser leakage.

The displays of assorted regulating devices include a new adaptation of the magnetic level indicator for working pressures up to 5000 psi. In this instrument the customary float actuator is replaced by a solid-block displacer of ceramic material whose weight is partially compensated by a supporting spring, producing an effect of buoyancy which the material itself does not possess.

The largest display in the exposition included a vertical condensate pump, a barrel-type boiler feed pump, switchgear, and circuit breakers—all new offerings—as well as displays of capsule bearings and a man-lift for use in powerhouses. A new magnetic air circuit breaker in this display featured an arc chute consisting of a series of ceramic baffle plates shaped to constrict and lengthen the arc, causing rapid interruption. A new insulating system was also disclosed that may prove of far-reaching advantage in generator and motor windings. The system utilizes a recent development in unsupported silicone-rubber film. Because the fabric base which silicone rubbers formerly required has been eliminated, new methods of application and production are permitted, and a re-evaluation of enclosures is indicated, pointing toward extended life and more dependable machine operation.

An exhibitor of electric and electronic development displayed a vibration meter which accurately measures the displacement, velocity, and acceleration of mechanical vibrations in machines and structures. Another product is a pocket-sized sound-survey meter, said to be comparable in accuracy to the commercially available sound meters of only one or two years ago.

Another first showing was a vibrating-reed frequency meter. This simple and almost infallible instrument for use on panel boards to indicate alternating-current frequencies has no moving parts. Each reed in a comb responds to a definite vibration frequency, its fluttering forming a legible spot on the dial. The frequency of the supply circuit which is to be indicated is communicated to the reeds through the winding of an electromagnet.

A miniature television camera in projectile form, $5^1/_4$ in. in diam and 9 in. long, which was shown, helped to strengthen predictions that industrial TV is destined to become a common tool, not only for observing operations in hazardous locations, such as atomic research and reactor performance, but in remote viewing, testing, and checking human behavior, as well as that of mechanisms. The portable camera suggests many uses. Its associated control set weighs but 26 lb and is housed in a convenient carrying case.

A movement that has gained considerable headway in the Chicago area involves the conversion of motor vehicles from gasoline to LP gas operation, especially for in-plant truck operation. An exhibitor, starting less than a year ago in the conversion of existing equipment, has already built a substantial volume on the representation of fuel-cost reductions as high as 50 per cent, 50 to 75 per cent lower maintenance cost, and the strong advantage of a clean exhaust, remarkably low in CO.

Another Power Show innovation was a mobile emergency steam plant, mounted on a specially designed motor truck.

Partial view of Power and Mechanical-Engineering Exposition area in the Chicago Coliseum

ASME Coming Events

March 14–16
ASME Aviation Division Conference, Hotel Statler, Los Angeles, Calif.
(Final date for submitting papers was Nov. 1, 1955)

March 14–15
ASME Engineering Management Conference, Hotel Statler, St. Louis, Mo.
(Final date for submitting papers was Nov. 1, 1955)

March 18–21
ASME Spring Meeting, Multnomah Hotel, Portland, Ore.
(Final date for submitting papers was Nov. 1, 1955)

March 26–28
ASME Instruments and Regulators Division Conference, Princeton University, Princeton, N. J.
(Final date for submitting papers was Nov. 1, 1955)

April 1–5
ASME Oil and Gas Power Division Conference, Jung Hotel, New Orleans, La.
(Final date for submitting papers was Dec. 1, 1955)

April 10–11
ASME Machine Design Division Conference, Bancroft Hotel, Worcester, Mass.
(Final date for submitting papers was Dec. 1, 1955)

April 16–17
ASME Gas Turbine Power Division Conference, Hotel Statler, Washington, D. C.
(Final date for submitting papers was Dec. 1, 1955)

May 8–11
ASME Metals Engineering-AWS Conference, Hotel Statler, Buffalo, N. Y.
(Final date for submitting papers was Dec. 31, 1955)

May 23–25
ASME-EIC Meeting, Mount Royal Hotel, Montreal, Que., Can.
(Final date for submitting papers was Dec. 31, 1955)

June 14–16
ASME Applied Mechanics Division Conference, University of Illinois, Urbana, Ill.
(Final date for submitting papers—Feb. 1, 1956)

June 17–21
ASME Semi-Annual Meeting, Hotel Statler, Cleveland, Ohio
(Final date for submitting papers—Feb. 1, 1956)

Sept. 10–12
ASME Fall Meeting, Denver, Colo.
(Final date for submitting papers—May 1, 1956)

Sept. 17–21
ASME Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Coliseum, New York, N. Y.
(Final date for submitting papers—May 1, 1956)

Sept. 23–26
ASME Petroleum-Mechanical Engineering Conference, Conrad Hilton Hotel, Dallas, Texas
(Final date for submitting papers—May 1, 1956)

Oct. 8–10
ASME-ASLE Third Lubrication Conference, Chalfonte-Haddon Hall, Atlantic City, N. J.
(Final date for submitting papers—June 1, 1956)

Oct. 24–25
ASME-AIME Joint Fuels Conference, Sheraton-Park Hotel, Washington, D. C.
(Final date for submitting papers—June 1, 1956)

Nov. 25–30
ASME Annual Meeting, Hotel Statler, New York, N. Y.
(Final date for submitting papers—July 1, 1956)
(For Meetings of Other Societies, see page 109)

ASME Endorses IAESTE Plan for On-the-Job Training

C. E. Davies, secretary ASME, made the following announcement at the Members and Students Luncheon, held during the Society's Diamond Jubilee Annual Meeting.

IAESTE Established in 1948

In 1948 universities and industries of nine countries of Western Europe joined together to establish the organizational framework for a unique and outstanding international arrangement to provide on-the-job training for advanced students of science and technology in countries other than their own. This nonprofit, nongovernmental organization was called the International Association for the Exchange of Students for Technical Experience (IAESTE). Headquarters were established in London. Its creation was prompted by the consensus of industrial and academic circles that the preparation of an undergraduate for industry is enhanced appreciably by an opportunity for him to develop critical faculties in observing abroad new technical and intellectual methods.

By 1955 the number of participating countries had risen to 21. These include Austria, Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Iceland, India, Israel, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, U. S. A., and Yugoslavia.

In the course of the past summer, a total of 5130 student trainees were exchanged with the co-operation of 2500 industrial firms. Despite its critical shortage of engineers and its efforts to improve training methods for its engineering students, United States participation has been abnormally small. In 1955 the United States received only 39 student trainees under this program and sent abroad only 20. In the past three years Canada received 50 students and sent 12 students abroad.

Institute of International Education Co-Ordinating Agency

Last spring, with the full support of the American Society for Engineering Education and the Engineers' Council for Professional Development, the Institute of International Education, New York, N. Y., agreed to serve as the central U. S. co-ordinating agency in administering the IAESTE program, R. M. Gates, Hon. Mem. ASME, representing the Society. It is moving forward with plans for U. S. participation for the summer of 1956, which it is hoped and fully expected will, for the first time, reach proportions commensurate with the recognized potential of the program. An Advisory Committee under the chairmanship of M. M. Boring, Mem. ASME, president of ASEE, and composed of representatives of industry, professional-engineering societies, engineering schools, and the U. S. National Student Association has been appointed to advise the Institute on the conduct of the program. Mr. Gates and C. E. Davies, secretary ASME, serve as representatives of the Society.

IAESTE Program

Under the IAESTE program students are sent abroad for technical training during their summer vacation for a minimum period of eight weeks. They may indicate their choice of country from among the members of IAESTE as well as their particular field of interest. In order to qualify for the program student applicants must fulfill the following conditions: Have completed their third year of engineering study; be willing and able to pay their own transportation to and from the country where he will be training; have had practical experience in his own country; be endorsed by officials of his school; and pay a $5 registration fee at the time he applies. This fee will be returned to him in the event his placement abroad is not possible. The receiving company will pay the trainee a weekly wage sufficient to cover his maintenance while actually employed and a nominal administrative fee to help sustain the program generally.

Engineering deans of all accredited engineering colleges are being sent information on the program and forms for use of those students who wish to apply. Simultaneously, American industry is being approached for placement opportunities for foreign trainees in this country. Placement offers and student applications will be reconciled at a meeting of the 21 National Committee representatives in Trondheim, Norway, in January, 1956.

America has much to offer and to gain in this program and Mr. Davies urged its support. The Institute of International Education, 1 East 67th Street, New York, N. Y., will be pleased to receive any suggestions anyone may have on the program generally, and as to American companies which it is believed might be interested in participating.

Improved Utilization of Engineering Manpower, Keynotes EJC General Assembly

The second General Assembly of the Engineers Joint Council will be held January 26 and 27 at the Hotel Statler, New York, N. Y. The American Society of Mechanical Engineers, as a constituent body of EJC, will participate.

Thursday, January 26, will be devoted to manpower sessions sponsored by EJC and Scientific Manpower Commission. The over-all theme of the day's discussions is "Improved Utilization of Engineering Manpower." The morning sessions will provide a report and discussion of the meaning of Public Law 305—the Reserve Forces Act of 1955—to the utilization of engineers, scientists, and other specialized personnel. The three persons bearing top governmental responsibility for these matters have agreed to be present for short formal presentations followed by discussion. They are: General Lewis B. Hershey, Director of the Selective Service System; Carter L. Burgess, Assistant Secretary of Defense for Manpower and Personnel; and Brigadier General Carlton S. Dargusch, Assistant Director for Manpower in the Office of Defense Mobilization. This, it is believed, will be the first time the triumvirate bearing major responsibility for military and related manpower problems in government will be available on the same platform to represent the over-all picture.

Brain Power—Our Greatest Asset

The luncheon speaker, Frank H. Bowles, director, College Entrance Examination Board, will discuss under the title "Brain Power—Our Greatest Asset" a current picture of the relation of our nation's brain-power potential to estimated needs. For this purpose the summary of the results of the Survey of Demand for Engineers and Engineering Technicians by the EJC Special Surveys Committee, a study now under way, will be presented. The implications of this and long-range evaluations of our manpower need as against our potential will provide an interesting backdrop for the afternoon sessions.

"Extending Engineering Manpower by Utilizing Teams of Engineers and Engineering Technicians" is the theme of the afternoon session. This will not be a "glittering-generalities" session but a specific analysis of the principal ideas and problems involved in the efficient integration of engineers and engineering technicians on the engineering team.

Eric A. Walker of The Pennsylvania State University will open the session with an assessment of the "Preparation and Relative Capabilities of Engineers and Engineering Technicians." This will be followed by a presentation by L. E. Saline, Assoc. Mem. ASME, of the General Electric Company on the "Recruitment, Training, and Placement of Technical Institute Graduates—A Centrally Controlled Program." S. W. Herwald, Mem. ASME, engineering manager, Air Arm Division of the Westinghouse Electric Corporation, will then discuss "Planning the Ideal Engineer-Engineering Technician Team in a New Engineering Department."

A series of short presentations on the specific methods used to achieve an efficient engineering technician team in various industries will follow. These will include the automotive, aircraft, heavy-construction industry, petroleum and chemical industries, and Government Public Works activities. The program has been arranged to permit an open-end discussion period so that individual problems and questions may be discussed with program participants.

Growth Pattern of the Engineer

The morning of Friday, January 27, will present a discussion of "Growth Pattern of the Engineer." Panel moderator will be Sidney Kirkpatrick of the McGraw-Hill Book Company.

The educator's viewpoint will be discussed by Dean Morrough P. O'Brien, Mem. ASME, chairman, department of engineering, University of California; industrial aspects, by James R. Taylor, director of public relations, Procter & Gamble Company, Cincinnati, Ohio; and the employee's viewpoint, by Robert Nelsen, Assoc. Mem. ASME, General Electric Company, Cincinnati, Ohio. Various human problems in engineering will be discussed by Earl Brunner of Rogers, Slade & Hill.

At the luncheon on Friday, S. C. Hollister, dean, School of Engineering, Cornell University, and a member of the Hoover Commission, will speak on the "Objectives of the Hoover Commission." The afternoon will then be devoted to a review of "The Engineering Aspects of the Hoover Commission Reports." Mervin Kelly, president, Bell Telephone Laboratories, will discuss "Research and Development Aspects of the Hoover Commission Reports" and Admiral Ben Moreell of Jones & Laughlin Steel Company will talk on the "Hoover Commission Water Resources Report."

At dinner on Friday evening, Thorndike Saville, dean of engineering, New York University, and retiring president of Engineers Joint Council, will address the Council.

Guest speaker, Walker L. Cisler, Fellow ASME, president of the Detroit Edison Company, will deliver a talk on "A World Look at Usefulness of Nuclear Power."

1954-1955 UET Report Covers Officers, Finance, and New Engineering Center

Engineering Societies Library and Engineering Foundation Report

THE United Engineering Trustees, Inc., recently released its annual report of the fifty-first year, 1954–1955, of its operation. The report was issued by Walter J. Barrett, president, on Oct. 28, 1955. The following excerpts are from Mr. Barrett's report:

At the beginning of the fifty-first year of operation of United Engineering Trustees, Inc., Oct. 1, 1954, the make-up of the Board of Trustees was the same as during the latter part of the preceding year. However, a number of changes in make-up and organization of the Board were to take place. At the annual meeting on Oct. 28, 1954, W. F. Thompson (ASME) was elected vice-president for a two-year term to 1956. During January, 1955, the Board very reluctantly accepted the resignation of former vice-president, G. F. Moulton (AIME). To succeed him as a Trustee the AIME appointed Andrew Fletcher, past-president of that Society. During February, 1955, AIME adopted the policy of being represented on the Board of Trustees only by members of its governing body. This resulted in the replacement of UET President J. L. Head and past-president E. C. Meagher, as Trustees, by Carl E. Reistle, Jr., and A. B. Kinzel, respectively. Under the by-laws Walter J. Barrett, who was then senior vice-president, automatically became president of UET and was confirmed in this office by action of the Board of Trustees.

Finance

Our portfolio is divided into two sections—the Combined Fund, which includes gifts and bequests for the benefit of Engineering Societies Library and Engineering Foundation, the principal of which must be held intact, only the income being used for the purpose of the gift; and the Depreciation Fund for the headquarters building. These two funds are necessarily treated differently—the Combined Fund in anticipation of safety of principal, long holding of investments, and maximum safe return to fulfill the objectives of the gifts; and the Depreciation Fund for safety of principal but in anticipation of advantageous disposal on relatively short notice for use in connection with a new Engineering Center. To the latter, accretions are made yearly of $20,000 from building income, and of the interest from the investments which adds nearly twice as much more yearly. Its book value at the close of the fiscal year was $1,020,460.07 and its market value, $1,282,000. The Combined Fund book value is $1,380,159.91 and market value, $2,015,000. Any sale or purchase of securities has been for the purpose of strengthening the portfolio.

Fiduciary Functions. The corporation receives, banks, or invests, temporarily, and disburses on proper authority, contributions made to projects of the Engineering Foundation. It acts as treasurer for Engineers' Council for Professional Development, and as custodian for the funds of the John Fritz Medal Board of Award and the Daniel Guggenheim Board of Award.

Engineering Societies Building

Our building has been the headquarters of the Founder Societies and other engineering groups for 49 years. In that time the membership has increased more than tenfold and the result has been such expansion in the operations and staffs of the societies that two of the Founders necessarily maintain offices for certain of their functions off the premises and a number of Associates have moved out to larger space. Anticipating for many years that a remedy for this condition would be found, all possible repairs and maintenance have been deferred. Needed in the very near future are refenestration, completion of elevator renovation, additional elevators, repiping for water and steam, additional electric wiring to accommodate new office machinery and air conditioning. It is hoped that none of these major operations will demand emergency treatment before a decision is reached on a new location.

The current tax-exempt assessment valuation on the property is $460,000 for land and $520,000 for building. Fire insurance (including extended coverage) is maintained at $1,904,000 above foundation. Our Insurance Counsel, Frank & DuBois, reported the premises in continued excellent condition with high-grade maintenance.

All available space in the building is occupied on a self-sustaining basis, with no change in occupancy during the year. Several specialized engineering societies which are eligible as Associates, including some formerly housed here, have signified their interest in obtaining headquarters space in any new engineering center which may be erected.

New Engineering Center

The year has seen considerable activity in the consideration of the problem of acquiring a new headquarters building for the engineering societies. Early in 1955 the Committee of Five Presidents which had been established in April, 1954, submitted a report and recommendation to the four Founder Societies and the American Institute of Chemical Engineers. They recommended the location of a new center on one of the sites under consideration in Pittsburgh, Pa. At the request of the governing bodies of certain of the societies, this recommendation was amplified and resubmitted, specifically naming the Schenley Park location. While this recommendation has not been approved by the societies as a group, the offer of certain Pittsburgh interests to help finance a building there has, on request, been extended into 1956, and the Committee of Five Presidents has been discharged.

Early in June, 1955, 21 industrialists and educators from all parts of the country communicated to UET, the four Founder Societies, and the American Institute of Chemical Engineers, an offer to organize a nationwide committee to raise the necessary funds for a new headquarters, over and above those funds already available for the purpose, if the location were chosen from the broad viewpoint of the long-range interests of the societies in serving their profession and the nation, and having in mind maximum effectiveness of the societies' operations. They proposed that the societies employ outside counsel for studies to determine the best location, and offered to provide the funds to cover the cost of such studies. Thus far, the societies as a group have neither accepted nor declined this offer. On July 25, 1955, a group comprising the Presidents of ASCE, AIME, ASME, and AIChE, and a past-president of AIEE, delegated for the purpose, recommended to the five societies the establishment of a Special Task Committee of 15 (three from each society) charged with the duty of recommending a specific site for the new center based upon a review and comprehensive additional study of feasible locations, and that this Special Task Committee be empowered to engage independent, unbiased, professional consultants to investigate the problem. It is clear that this action is not necessarily a step in the direction of accepting the offer to raise funds made by the 21 indus-

trialists and educators, since the Special Task Committee is given no instruction that its approach to the problem is to be on the broad-gaged basis named by the 21 as a condition of their support. Furthermore, the societies plan to pay the cost of the proposed study out of their own funds.

ASME Members on the UET Board of Trustees are: Harold E. Martin, Willis F. Thompson, and Joseph L. Kopf.

Engineering Societies Library

Noteworthy of mention in the report is that there was an outstanding increase in the number of words translated and the number of orders for bibliographies. The 70 per cent increase during the past five years in the use of the Library's photoprint, microfilm, search, translation, and bibliography services is an impressive record.

Statistics of Library Use

	1953–1954	*1954–1955*
Visitors served.....total	16,817	18,696
Nonvisitors served...total	21,278	21,740
	38,095	40,436
Photoprint orders	4,704	4,598
Photoprints	63,506	65,728
Microfilm orders	295	330
Bibliography orders	586	781
Searches and paid services	127	142
Translations	161	204
Words translated	260,335	425,156
Borrowers	1,270	1,357
Books loaned	1,640	1,753
Telephone inquiries	9,349	10,501
Written replies to inquiries	4,786	3,827

Promotion of the Library

In a contest sponsored by the publishers of *Iron Age* to locate the oldest available issue of *Iron Age*, the Library's January 2, 1873, issue was the oldest one submitted. The Library Board voted to use the $500 first-prize award, for promotion of the Library. The Library received considerable publicity as winner of the contest.

Part of the money from the award has been used to purchase a Tel-A-Story projector which shows 12 transparencies in sequence. It will supplement the large exhibit acquired three years ago, which is still being used effectively at the larger meetings of the societies. The two small peg-board exhibits acquired about a year ago have not been as effective as anticipated.

Library Board Chairman, Mr. Vieth, and the Director, each participated in one of the 75th Anniversary Meetings of the ASME. Mr. Baumeister and the Director met with the ASME Executive Committee to report on the Library.

The Library Collection

Periodicals and other serial publications have always formed an important part of the collection as they report new developments promptly and they cover details and specific subjects not usually found in books. Increased time has been given to the study of periodicals being received. As the character or quality of some changed or deteriorated, subscriptions to them were discontinued. Many new periodicals have been examined and some of them have been added to the collection. The net gain in the number of periodicals received is 33 over a year ago.

Periodicals received:	*1953–1954*	*1954–1955*
Subscription	358	370
Exchange	280	291
Gift	755	765
	1,393	1,426

Miscellaneous Activities

The Library staff prepared reviews of 605 books valued at $4000, an 8 per cent increase over last year. These reviews were supplied to the four Founder Societies, the Engineering Institute of Canada, and The Engineering Index. In addition to the value of books received for review, the Library spent $2145 for books that were not reviewed.

The tenth bibliography in the series of ESL Bibliographies was issued under the title "Bibliography on Unionization of Professional Engineers."

An inventory, the first in 24 years, was taken of all books (but not periodicals) in the Library, some 80,000 volumes. Every book was checked against the shelf list to determine what books are missing, and to locate any that might be shelved in the wrong place. Some 400 books were missing. Although the physical checking of the books was completed, the aftermath of catalog changes will require much more time.

New additions to the card catalog were microfilmed on one roll. This, and the 35 rolls that had been in a UET safe-deposit box in a bank vault in New York City, were sent to the vaults of the Iron Mountain Atomic Storage Corporation, Hudson, N. Y

The Director was elected to the Board of The Engineering Index. He was chairman, and is still active on the ASA Committee Z39 on Standardization in Library Work and Documentation. He is chairman of the Subcommittee on Selection of Scientific and Technical Periodicals to be indexed in the Industrial Arts Index. He was a member of the Special Libraries Association's committee that prepared the recently published "Bibliography of Engineering Abstracting Services."

The Engineering Societies Monographs Committee, of which the Director of the Library is chairman, received three original manuscripts and a proposal for republication of the two Prandtl-Tietjens monographs published in 1934 and now out of print. All were still under consideration at the end of the year. Royalties received by the Library since the Engineering Societies Monographs series started in 1931 amount to $12,471.09.

F. M. Gilbreth and Theodore Baumeister represent The American Society of Mechanical Engineers on the Engineering Societies Library Board.

The Engineering Foundation

At the fortieth annual meeting of the Board of the Engineering Foundation, on Oct. 21, 1954, grants totaling $71,500 were approved for the support of 28 projects. All these projects, except two, were active during the year: One failed to meet the contingency set by the Board, the other did not secure a competent research associate until near the end of the year, and used only a portion of its grant for necessary equipment.

Excluding the firmly established Welding Research Council, to which the Foundation makes an annual token grant of $1,000, Foundation contributions during the fiscal year of approximately $65,000 stimulated research that cost nearly $400,000. This effect, which has been particularly pronounced during the past ten years, is unique in the history of research foundations, and it is undoubtedly the principal reason why sponsorship and early support is eagerly sought from the Foundation for projects that expect liberal industry support later.

The distribution of Foundation grants among the Founder Societies and independently for the fiscal year 1954–1955 was as follows:

ASCE	3 projects	$ 3,000	(5%)
AIME	8 projects	25,500	(39%)
ASME	7 projects	11,000	(17%)
AIEE	3 projects	9,150	(14%)
Joint Society activities	3 projects	11,500	(18%)
Independent research	3 projects	4,500	(7%)
Total	27 projects	$64,650	(100%)

ASME Projects

During the year just ended, the ASME Research Committee on Heat Conduction Charts (EF 108) secured contributions and pledges of $12,000 which will enable it to begin work immediately. The first collection of data will consist of charts showing the rate of temperature change against temperature.

The important work planned to extend the 1934 Steam Tables (EF 113) is ready to begin, and ASME is now engaged in executing agreements with several research institutions. Cash on hand and firm pledges total $105,000.

New Rules of Administration

The rules under which the Engineering Foundation operates were last amended, and then only slightly, in 1946. For about ten years these rules were subject to sporadic criticism owing to the long interval between the June meeting, when grants to projects were tentatively approved, and the late October meeting, when they received the approval of the incoming Board and thus became available. These criticisms came in part from the research committees of the Founder Societies and in part from leaders in engineering research in universities who could not be sure that a Foundation grant would be available until well after the beginning of the academic year—too late to secure competent research associates.

At the June, 1954, meeting, the chairman of the Foundation, acting under authority conferred by the Board, appointed a special committee consisting of E. M. Barber, W. M.

Peirce, and C. S. Purnell, with L. G. Holleran as chairman, to study the rules and make recommendations for improvement. This Committee together with the Director, prepared several suggested drafts, which were circulated to the Board. The final draft, worked out by the Committee on September 30, was sent to the Board, which approved the new rules at a special meeting, December 8, 1954. These rules became effective January 1, 1955.

The principal change in the rules consisted in moving the annual meeting from late October to early May, and adjusting the timetable for submitting applications for grants and making reports in accord with this change. At the annual meeting in May, the new officers and new members of the Board are slated, and the final budget, containing allotments for grants, is approved. Each grantee is notified not later than May 15 that the Foundation's contribution to his project becomes available on October 1, the beginning of the fiscal year (which is unchanged), which gives grantees about $4\frac{1}{2}$ months to secure satisfactory personnel and make other plans for the research. The new rules have now been in effect nine months, and no adverse criticism has been noted.

Public Relations Committee

The Public Relations Committee has supervised the preparation of several releases, and the reception by engineering editors of these releases has been good, so far as can be ascertained from tear sheets received by the Director. The chief job of the Committee during the past fiscal year has been the revision of the brochure which is distributed at Founder Society meetings. The new brochure has just been received from the printer and will be available for the fall meetings of the Founder Societies.

NCSBEE Annual Meeting Held in Washington, D. C.

The thirty-fourth annual meeting of the National Council of State Boards of Engineering Examiners held in Washington, D. C., Oct. 20–22, 1955, was attended by 134 delegates from 46 states, the District of Columbia, Alaska, and Canada, and 18 honor guests representing engineering societies. C. E. Davies, secretary, ASME, represented The American Society of Mechanical Engineers.

President John W. Gore, from Baltimore, Md., presided at all business sessions and the annual banquet.

The principal discussions at the meeting were in connection with the annual reports of the Standing Committees of the National Council. The Committee on Engineers in Training presented a collection of examination problems to be used by state boards or registration as a guide for preparing their examinations, and these will not be distributed to the public. The Committee on Uniform Laws and Procedures presented amendments to the list of "Suggested Standards" which were approved, and it was reported that revised sheets for those states that have made changes in their registration laws or procedures will be prepared. These revised sheets will be printed by the National Council and distributed to Member Boards and to those persons who have copies of the Synopsis. Copies of the Synopsis are sold at $5 each.

The Annual Banquet was an outstanding feature of the meeting and was attended by over 200 persons. The speaker was Major General Charles G. Holle, Deputy Chief of Engineers for Construction, U. S. Army, who was introduced by Gail A. Hathaway, Special Assistant to Chief of Engineers, U. S. Army. The subject of General Holle's address was "The Engineer—Key Man in Modern Technological Society."

The National Council's Distinguished Service Certificate was awarded to Col. Marcel Garsaud of New Orleans, who was the first president of the National Council, and to the following members of NCSBEE who have served on their respective State Board of Registration for over 20 years: J. M. Gallalee, Fellow ASME, Alabama; H. T. Person, Wyoming; W. K. Simpson, Mem. ASME, Connecticut; W. W. Hodge, West Virginia; M. K. Snyder, Washington; D. B. Jett, New Mexico; and Joseph Weil, Florida. The Certificate was also awarded to C. E. Davies, secretary, ASME, in recognition of his cooperation with, and services to, the National Council.

The new officers elected were: President, Bruce Williams, Joplin, Mo.; President-Elect, Edward R. Stapley, Stillwater, Okla.; Director, Northeast Zone, W. H. Larkin, Mem. ASME, New York, N. Y. The officers who hold over for another year are: Past-president, John W. Gore, Baltimore, Md.; Director, Western Zone, A. L. Henny, Portland, Ore.; Director, Southern Zone, J. M. Gallalee, University of Alabama.

ASME Lubrication Division Announces Officers

At the ASME Diamond Jubilee Annual Meeting, the Lubrication Activity was dissolved by its Executive Committee, and E. W. Jacobson, chairman of the Professional Divisions Committee, installed the officers of the new Lubrication Division. Members of the Executive Committee of the new Division are: D. F. Wilcock, chairman, O. L. Bridgeman, vice-chairman, J. T. Bunting, secretary, W. H. White and S. Abramovitz.

In installing the new officers, Mr. Jacobson briefly reviewed the work of the Lubrication Activity which was formed as a result of the recognized need for Division activity and research in a single group. The new Lubrication Division carries the responsibility of bringing prestige to the ASME in the field of lubrication and the Society is looking forward to a strong and stimulating group.

Committee chairmen approved by the Division's Executive Committee include: R. W. Flynn, Program Committee; E. M. Phillips, Membership Development; S. Abramovitz, Lubrication Conference; R. B. Purdy, Publicity, A. C. Stutson, Advisory; O. C. Bridgeman, Research; W. H. White, Lubricants; and S. Abramovitz, Design.

Freeman Fellowship Announced

The 1956 Freeman Fellowship for study or research in hydraulics has been announced. ASME and the American Society of Civil Engineers are joint administrators of the Fund, first established in 1924 by John R. Freeman, past-president and Hon. Mem. ASME.

The Freeman Award Committee makes awards through these societies in alternate years. This year the award could reach $3000 depending on the need claimed in the application.

Any qualified member of the societies may apply to the Freeman Award Committee for this Fellowship. He must submit a study or research program covering a period of at least nine months beginning in 1956. In addition to furnishing evidence of his qualifications to carry out the proposed program, an applicant must be a United States citizen.

Applicants working on defense projects will be given preference by the Award Committee, according to the announcement. The award winner will be named on March 15, 1956. Sixty days after he has completed his project, the awardee must make a report in English.

Interested people should submit applications by Feb. 1, 1956, to the Freeman Award Committee, Secretary, The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y.

Thousands View Chicago Automation Show

Short cuts in time and distance that automation makes possible were demonstrated by exhibits at the International Automation Exposition at Navy Pier, Chicago, Ill., Nov. 14-17, 1955. More than 150 exhibitors showed the most up to date in automatic-control systems, electronic computers, data-handling equipment, conveyers, counters, communication systems, industrial television, photoelectric controls, positioning equipment, scanning systems, speed controls, automatic production lines, automation components, servomechanisms, switches, relays, and other electric components.

At the show one could feed complicated mathematical questions into a keyboard in a booth operated by Logistics Research, Inc., Redondo Beach, Calif. The questions were flashed thousands of miles by wire to an electronic digital computer in Redondo Beach which answered the question. The answers were flashed back—all in a few seconds.

Data-Handling Equipment

Forty-one companies at the exposition showed data-handling equipment such as computers, machine controls, and memory-storage units which make such operations possible. Reams of literature were available on the functions of the various components and, more important, material was freely distributed on automation and what it means.

Farrand Optical Company, New York

N. Y., displayed an automatically operated milling machine with a keyboard that stores 15 complete operations. By using a punch tape, instructions and dimensions of the parts the machine makes could be sent by an electronic communication system to any factory in the world with similar equipment in probably less than an hour, according to a company spokesman.

Different languages, said Richard Rimbach, Mem. ASME, exposition manager, are no barrier with punch or magnetic tapes and electronic-communication systems that handle messages by a code system.

A timesaver in the chemical field was exhibited by Precision Scientific Company, Chicago, Ill.; it is an automatic chemical analyzer which eliminates such tedious tasks as stirring and continual observation of the laboratory work in progress.

In addition to the exhibits, nine clinics were held daily on electronic computers and four on conveyers.

Another avenue of interest was featured in an exhibit by the Counter and Control Corporation of Milwaukee, Wis., demonstrating how the programming and automatic recycling of complex switching functions are accomplished by electromechanical means. The device known as the programonitor is basically a counter. It handles shaft speeds up to 4000 rpm. The drive shaft and geared counting system are positively connected to the driving source so that miscount cannot occur.

A rival to transistors and magnetic cores was demonstrated by Potter Instrument Company, Great Neck, N. Y. These basic circuit elements called magnistors have all the advantages of transistors and magnetic cores without the attendant disadvantages. The principal applications of this basically new magnetic element will be in high-speed computers, business data-handling systems, automation-control systems, high-speed counters, and magnetic tape systems.

Representatives of industry, colleges, and research who attended The American Society of Mechanical Engineers' first cavitation seminar Nov. 11–13, 1955, at Allis-Chalmers Manufacturing Company, West Allis, Wis., are, front row, *left to right,* William C. Stewart, superintendent, Metallurgical Laboratory, U. S. Naval Experiment Station, Annapolis, Md.; Robert T. Knapp, Mem. ASME, chairman, Hydrodynamics Laboratory, California Institute of Technology, Pasadena, Calif.; W. H. Wheeler, Mark Laboratories, Keston, Kent, England; W. C. Leith, Dominion Engineering Company, Ltd., Montreal, P.Q., Canada; Jack Crowley, Department of the Navy, Office of Naval Research, Washington, D. C.; and Ray S. Quick, Fellow ASME, consulting engineer, Eddystone Works, Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa.; middle row, *left to right,* Hunter Rouse, Mem. ASME, director, Iowa Institute of Hydraulic Research, University of Iowa; J. W. Daily, Mem. ASME, chairman, Hydrodynamics Laboratory, Massachusetts Institute of Technology, Cambridge, Mass.; S. Logan Kerr, Fellow ASME, consulting engineer, Flourtown, Pa.; B. A. Holmes, assistant engineer, The Hydroelectric Power Commission of Ontario, Toronto, Ont., Can.; B. G. Rightmire, Mem. ASME, Massachusetts Institute of Technology, Cambridge, Mass.; D. V. Kececioglu, Assoc. Mem. ASME, research engineer, Allis-Chalmers Research Laboratories; back row, *left to right,* G. Dugan Johnson, Mem. ASME, chief hydraulic engineer, S. Morgan Smith Company, York, Pa.; J. F. Roberts, Fellow ASME, vice-president, director of engineering, Industries Group, Allis-Chalmers Manufacturing Company; Frank E. Jaski, Mem. ASME, engineer in charge of pump turbines, Allis-Chalmers Manufacturing Company; H. L. Ross, Mem. ASME, assistant manager, centrifugal pump department, Allis-Chalmers Manufacturing Company; W. B. Hess, Mem. ASME, engineer, Safe Harbor Water Power Corporation, Conestoga, Pa.; John Parmakian, Mem. ASME, head, Technical Engineering Analysis Section, Bureau of Reclamation, Denver Federal Center, Denver, Colo.; W. W. Weltmer, engineer, centrifugal pump department, Allis-Chalmers Manufacturing Company; H. P. Binder, manager, centrifugal pump department, Allis-Chalmers Manufacturing Company; and W. J. Rheingans, Mem. ASME, manager, hydraulic department, Allis-Chalmers Manufacturing Company. The seminar concerned itself with discussions that covered operating characteristics of magnetostriction equipment, laboratory demonstrations, parameter variations, and comparisons with other methods of determining cavitation resistance.

Nominations Open: 1957 ASME Officers

Take Advantage of Your Membership and Participate in the Management of Your Society

THE 1956 National Nominating Committee has the responsibility of selecting eminent leaders for the offices of the ASME to be elected by the members for 1957. It is the obligation, privilege, and responsibility of *every member* of the Society to assist the Committee in obtaining the best men available. You can do your part by acting as a sponsor for those members who have the acknowledged qualities for outstanding ability and leadership in their profession.

Offices to Be Filled

President	To serve 1 year
Vice-President	To serve 2 years, Region II
Vice-President	To serve 2 years, Region IV
Vice-President	To serve 2 years, Region VI
Vice-President	To serve 2 years, Region VIII
Director (Technical) (1)	To serve 4 years
Director (Administrative) (1)	To serve 4 years

Act Now!

Proposals will be welcomed by the Committee.

1 Proposed candidates' names and records should be submitted on the official proposal form which may be obtained from the Secretary of the National Nominating Committee or any of its members listed below.

2 Professional Divisions and Boards having to do with the technical work of the Society involved in publications, meeting programs, research, standardization, honors, and membership are encouraged to propose candidates.

3 Completed forms should be sent to the Secretary of the National Nominating Committee, Theodore N. Graser, Vice-President & Treasurer, Cochrane Steam Specialty Company, 55 Batterymarch Street, Boston 10, Mass. Proposals for Vice-Presidents are requested in advance of the respective Regional Administrative Committee meetings and proposals for all offices should be submitted before April 1, 1956.

4 The proposer, not the proposed candidate, should fill out the form.

5 Before submitting the name of a proposed candidate, the proposer shall ascertain that the proposed candidate will accept the nomination if tendered.

Members are reminded that in accordance with the Society's Constitution, candidates for office of President, Vice-President, and Director shall be of the grade of Fellow or Member. Members wishing to speak in support of any proposed nominee have the privilege of appearing before the National Nominating Committee at open hearings to be held during the Semi-Annual Meeting in Cleveland, Ohio, Hotel Statler, June 18 and 19, 1956.

1956 National Nominating Committee

Region I: ** T. N. Graser, Cochrane Steam Specialty Co., 55 Batterymarch St., Boston 10, Mass.; S. L. Grapnel, *1st Alternate*, Belding-Hemingway-Corticelli Co., Putnam, Conn.; R. M. Scott, *2nd Alternate*, Wire Division, Morgan Construction Co., 15 Belmont St., Worcester, Mass.

Region II: A. T. Kniffen, General Engineering Division, Air Reduction Co., Inc., 60 East 42nd St., New York 17, N. Y.; H. F. J. Skarbek, *1st Alternate*, American Aluminum Casting Co., 326 Coit St., Irvington, N. J.; J. L. O'Neill, *2nd Alternate*, Industrial Sales Division, Daystrom Electric Corp., 753 Main St., Poughkeepsie, N. Y.

Region III: J. W. Putt, Hahn Motors, Inc., Hamburg, Pa.; E. H. Hanhart, *1st Alternate*, consulting mechanical engineer, 9 McKim Ave., Baltimore 12, Md.; Sigmund Kopp, *2nd Alternate*, Alco Products Division, American Locomotive Co., Roberts Road, Dunkirk, N. Y.

Region IV: R. N. Benjamin, Georgia Power Co., Box 1683, Atlanta 1, Ga.; T. J. Judge, *1st Alternate*, Southern Kraft Division, International Paper Co., Box 1649, Mobile, Ala.; H. K. Couch, *2nd Alternate*, Brown & Morrison, 207 Liberty Life Building, Charlotte 2, N. C.

Region V: H. N. Muller, Jr., Westinghouse Electric Corp., 401 Liberty Ave., Pittsburgh 30, Pa.; J. F. Cunningham, Jr., *1st Alternate*, Midwest Equipment Co., 545 W. Broad St., Columbus 8, Ohio; A. B. Heiberg, *2nd Alternate*, Firestone Tire & Rubber Co., 1200 Firestone Parkway, Akron 17, Ohio.

Region VI: R. W. Mills, 101 Architectural Hall, University of Nebraska, Lincoln, Neb.; G. H. Frost, *1st Alternate*, general engineering department, Iowa State College, Ames, Iowa; C. A. Davis, *2nd Alternate*, Deere & Co., 1325 Third Ave., Moline, Ill.

Region VII: H. A. Johnson, mechanical-engineering department, University of California, Berkeley 4, Calif.; D. S. Angell, *1st Alternate*, Kaiser Aluminum & Chemical Corp., Trentwood, Spokane, Wash.; W. A. Biddle, *2nd Alternate*, Boyd Engineering Co., Inc., 1600 W. Jefferson St., Phoenix, Ariz.

Region VIII: * H. B. Atherton, Kansas City Power & Light Co., Postal Station "F," Kansas City 1, Mo.; R. W. Cox, *1st Alternate*, Dallas Power & Light Co., 1506 Commerce St., Dallas 1, Texas; R. B. Kinzbach, *2nd Alternate*, Kinzbach Tool Co., Inc., 2411 Summer St., Houston 1, Texas.

Technical Division: S. G. Eskin, The Dole Valve Co., 1933 Carroll Ave., Chicago 12, Ill.; Otto de Lorenzi, *1st Alternate*, Combustion Engineering, Inc., 200 Madison Ave., New York 16, N. Y.; H. L. Solberg, *2nd Alternate*, School of Mechanical Engineering, Purdue University, Lafayette, Ind.

Codes and Standards: F. S. G. Williams, Taylor Forge & Pipe Works, Box 485, Chicago 90, Ill.; H. N. Blackmon, *1st Alternate*, Association Activities, Westinghouse Electric Corp., Office 7-L-38, East Pittsburgh, Pa., A. W. Meyer, *2nd Alternate*, Brown & Sharpe Manufacturing Co., Providence 1, R. I.

Administrative: L. E. Herbert, Knolls Atomic Power Lab., General Electric Company, Schenectady 5, N. Y.; R. H. Stockard, *1st Alternate*, University of Rhode Island, Kingston, R. I.; Robert Nelsen, *2nd Alternate*, Field Engineering, General Electric Co., Cincinnati 15, Ohio.

* Chairman.
** Secretary.

Junior Forum

Conducted for the National Junior Committee

by R. A. Cederberg,[1] Assoc. Mem. ASME

William A. Shoudy, chairman of the Old Guard, addresses a meeting of the National Junior Committee held during the ASME Diamond Jubilee Annual Meeting. Seated at the head of table one sees Joseph Schmerler, *left,* incoming chairman of the Committee, and Charles T. Miller, *right*, outgoing chairman.

National Junior Committee Looks to the Future

"The young Associate Member can do a great deal to strengthen the Society." So spoke William A. Shoudy at a meeting of the National Junior Committee held during the 1955 Diamond Jubilee Annual Meeting of ASME in Chicago, Ill., November 13–18. The meeting was the first of two activities handled by the Junior Committee at the Chicago meeting. At an evening session, Andrey A. Potter and Andrew J. Snider, 3rd, gave talks directed to the young men in the Society.

The afternoon meeting, attended by guests of the Old Guard, several officers of the Society, and members of the National Junior Committee and the Old Guard, was highlighted by a proposal presented by Joseph Schmerler, new chairman of the National Junior Committee. This proposal calls for an organization that would tie the Junior Committee in closer with prospective members and new members of the Society. Specifically it calls for:

1 At the National level—a subcommittee of the Junior Committee to work with National Committees on Student Relations and Membership Development.

2 At the Regional level—an Associate Member to sit on Regional Committees on Student Relations and Membership Development. This person would be a member of the subcommittee of the Junior Committee mentioned in (1), or

The appointment of a reporting representative of the Junior Committee to sit with Regional Committees on Student Relations and Membership Development.

3 At the Section level—(*a*) Associate Member would sit on Section Committee on Student Relations and Membership Development; (*b*) a reporting representative of the Junior Committee would be appointed to sit with the Section Committee on Student Relations and Membership Development; or (*c*) a member of the Section Student Relations and Membership Development Committee would be assigned to correspond with the Junior Committee.

After general discussion it was decided that the proposal should be presented to the Regional Vice-Presidents prior to the close of the Chicago meeting.

Also at the afternoon meeting came a proposal designed to bring into the Society, and then keep active, a larger percentage of the young mechanical-engineering graduates. This proposal, to be given a pilot run in Region II, will result in a member of the Old Guard, or a designated representative, getting in touch with persons who have just transferred from Student to Associate Member, taking them to dinner and later to a regular Section meeting of the ASME. At the meeting the Old Guard member would introduce the new man to the Section officers and others present. It was felt that such a procedure would eliminate much of the criticism that new members are "cold-shouldered" at Section meetings. A personal acquaintance with the Section officers would place the new man in a position to be assigned tasks that would make him feel that he was a part of the Society and was gaining something from Society membership.

Before the afternoon meeting had adjourned, a number of interesting points were covered. They follow in capsule form:

President Barker, keenly interested in the younger men of the Society, hopes to develop a closer affiliation between the Student Branches and the Sections.

Vernon A. Peterson stated that some students may not be transferring to Associate Membership because they are being graduated in January and may not be approached until a much later date, or at a time when they are being bombarded with other requests for their time and money. Old Guard will seek to improve the timing on the ASME "sales pitch."

The Junior Committee and the Old Guard

Andrew J. Snider, 3rd, sales engineer, Combustion Engineering, Inc., Chicago, Ill., described some of the problems of the young mechanical engineer starting his career, in his talk, "The Tyro Engineer—the First Ten Years"

[1] Westinghouse Electric Corp., Radio-Television Division, Metuchen, N. J.

Young engineers, some fresh out of engineering college, received helpful advice from one of the nation's outstanding engineering educators. A. A. Potter, dean emeritus of engineering at Purdue University, addressing the Junior Committee Session on "The Young Engineer in Industry and Commerce."

expect to work out a program whereby one member of each of their committees will call on the Student Branches and briefly discuss the engineer's place in industry and the Society.

The Society might find it worth while to direct more of its attention toward selling undergraduates at an early date on the importance of a professional spirit and membership in the Society. Must also try to improve the maintenance of membership program—especially as it effects those recently graduated.

Members of the National Junior Committee may find it less difficult to get money to travel to the executive meetings as a result of a suggestion presented by Mr. Barker.

By the time the evening meeting had gotten under way the room was overflowing, and many standees were noted. Under the chairmanship of Charles T. Miller, outgoing chairman of the Junior Committee, the meeting featured talks by one of the older "young" men of the Society, Andrey A. Potter, past-president and Hon. Mem. ASME, dean emeritus of engineering, Purdue University, and by one of the newer faces in the Society, Andrew J. Snider, 3rd, a sales engineer with Combustion Engineering, Inc., of Chicago.

Dean Potter's talk entitled "The Young Engineer in Industry and Commerce," contained a great deal of advice for the recent college graduate. He charged his audience to keep in mind always that it wasn't the old in years who were old, but those who were old in spirit and mind.

Mr. Snider gave a description of some of the problems and of the environment that would most likely be encountered when the young mechanical engineer first takes his place in industry. He also cautioned the young engineer to keep a sense of perspective and not let the salary, size of the desk, number of vacations, and so on, have a disproportionate weight when selecting the first or a new job.

Coming Meetings

Materials Handling

The department of industrial engineering, Purdue University, in conjunction with the Indianapolis chapter of the American Materials Handling Society, will sponsor a two-day conference on "Materials Handling," Thursday and Friday, February 16 and 17. All sessions will be held in the Purdue Memorial Union Building.

Electronics

The American Management Association will conduct its second annual electronics conference and exhibit at the Hotel Commodore, New York, February 27–29. The conference is designed for financial, office, and other executives interested in business applications of electronic equipment.

The conference program will stress two major aspects of the subject: Methods of determining whether and where it is feasible to use large, small, or medium-sized electronic computers in each company and the experience to date of firms that have already started to use them.

Another feature of the conference will be the initial showing of a training film on computers in business, a color sound slide film especially prepared by the AMA for this meeting.

Concurrent with the meeting will be an exhibit of electronic data-processing equipment. Eleven equipment manufacturers have reserved space to show electronic and related office equipment.

Each conference registrant will receive a handbook prepared exclusively for the meeting. It will contain original articles, pertinent background material, and illustrated descriptions of the equipment on exhibit.

Humanities and Engineering

Humanities and Engineering will be the theme of the eighth annual college-industry conference sponsored by the American Society for Engineering Education on January 26 at Marquette University.

The conference will be cosponsored by Marquette as part of its 75th anniversary celebration and by the Wisconsin Society of Professional Engineers whose two-day program on "Engineers and Public Affairs" will follow the college-industry conference.

ASME Membership

as of Nov. 30, 1955

Honorary Members	72
Fellows	409
Members	14,667
Affiliates	301
Associate Members (33 and over)	3,809
Associate Members (30–32)	4,490
Associate Members (to age of 29)	17,107
Total	40,855

Diamond Jubilee Events Mark Woman's Auxiliary to the ASME Annual Meeting

Reported by Mrs. Karl H. P. Otte

This year the Diamond Jubilee celebrations of The American Society of Mechanical Engineers provided additional emphasis when the Woman's Auxiliary to the ASME held its Annual Meeting from November 13 through November 18, 1955. This meeting is held every year concurrently with the ASME Annual Meeting.

It was with a great deal of pleasure that Chicago welcomed and extended her hospitality to the visiting women. The Jubilee Committee for the women's activities included: Mrs. Alexander Cowie, general chairman; Mrs. Robert Bacon, Mrs. Charles Parsons, and Mrs. Karl H. Otte, vice-chairmen; Mrs. Frank P. Lawler as chairman of the Chicago Section; and the Section members as hostesses for the visiting guests.

The Early-Bird Party

The first event of the Diamond Jubilee Annual Meeting was the Early-Bird Party, held on Sunday afternoon, November 13, for all ASME men and women. Mrs. Arthur B. Openshaw, Mrs. Charles Clark, and Mrs. M. V. Maxwell, whose husbands were members of the Hospitality Committee, cordially welcomed the guests to the Glass Hat Room of the Congress Hotel. A capacity crowd enjoyed the buffet and selected their favorite cocktails from the waiters as they moved among the group. The ensemble of musicians, who strolled from table to table playing requested selections, added much to the gaiety. At seven o'clock the party adjourned to the Boulevard Room at the Conrad Hilton Hotel for dinner and the colorful and lavish show featuring Frankie Masters and his Ice Carnival.

Registration

Registration for women was held each day, and Mrs. Frank P. Lawler, Chicago Section

The Hon. Ivy B. Priest, Treasurer of the United States, keynote speaker at the Annual Luncheon of the Woman's Auxiliary to the ASME, discusses program with a group of Chicagoans. *Left to right* are: Mrs. Karl H. P. Otte, Mrs. R. H. Bacon, Mrs. Priest, Mrs. Alexander Cowie, and Mrs. C. W. Parsons. In her talk Mrs. Priest said, "It's not gold and silver stored in the vaults that makes our nation strong, but the people pooling knowledge, skills, and know-how in one co-operative effort that gives us strength."

chairman, who was in charge, had a gracious welcome for each one. Total registration was 486. As each lady registered she was presented with a gold-and-rhinestone-wrapped complimentary memento of the Diamond Jubilee—an Elgin-American compact on which the official Diamond Jubilee emblem was imprinted. Mrs. H. A. Hanel was vice-chairman of registration. Others on the committee were: Mrs. Eugene C. Bailey, Mrs. Franklin Bogardus, Mrs. Frank Carvin, Mrs. Harry Erickson, Mrs. Chester Earle, Mrs. Gustav A. Gaffert, Mrs. John Hashagen, Mrs. Farel Hulick, Mrs. Adolph Langsner, Mrs. William Pletta, Mrs. James Rush, Mrs. E. B. Skubik, Mrs. O. I. Stangeland, Mrs. Vern L. Stone, Mrs. E. H. Throckmorton, Mrs. Irving L. Wade, Mrs. William Walsh, Mrs. George Williams, and Mrs. Charles M. Young.

Treasurer of the United States, Ivy Baker Priest, guest of honor at the Woman's Auxiliary to the ASME Annual Luncheon, was greeted on her arrival at the South Shore Country Club, Chicago, Ill., by Mrs. W. E. Karg, President, Woman's Auxiliary to the ASME, and David W. R. Morgan, 1955 President of ASME

Coffee Hour

The elegant Presidential Suite of the Congress Hotel was the setting for one of the most popular features of the women's program. Here at the Women's Headquarters, a continental breakfast was served to more than 100 women each morning. It was a place to rest, relax, and assemble before tours; but most of all, to become better-acquainted. Also, it furnished opportunity for all to meet and visit with our National President, Mrs. William E. Karg, and our other national officers; with Mrs. David W. R. Morgan, the wife of the retiring ASME President; Mrs. Joseph W. Barker, the wife of the incoming ASME President; and with Dr. Lillian M. Gilbreth. Credit for the friendly atmosphere and cordial hospitality belongs to Mrs. Robert Bacon and Mrs. Charles Parsons, chairmen, assisted by: Mrs. B. H. Allen, Mrs. Alex D. Bailey, Mrs. L. D. Bechtel, Mrs. Charles R. Bell, Mrs. Donald J. Bergman, Mrs. B. O. Boatman, Mrs. Franklin F. Bogardus, Mrs. R. C. Clough, Mrs. John Dolio, Mrs. Chester R. Earle, Mrs. Walter M. English, Mrs. Harry Erickson, Mrs. Maurice E. Fine, Mrs. David S. Frank, Mrs. Thane R. Halstead, Mrs. Richard S. Hartenberg, Mrs. Ralph J. Hinch, Mrs. Farel Hulick, Mrs. A. D. Kafadar, Mrs. Robert J. Kieckhefer, Mrs. Adolph Langsner, Mrs. J. C. Marshall, Mrs. Thomas McEwan, Mrs. John R. Michel, Mrs. Louis H. Niebling, Mrs. W. H. Ogden, Mrs. William H. Oldacre, Mrs. A. B. Openshaw, Mrs. William H. Pletta, Mrs. James J. Rush, Mrs. Carl E. Schmitz, Mrs. E. B. Skubik, Mrs. E. H. Throckmorton, Mrs. Robert Von Rotz, Mrs. Ernest Welsh, Mrs. George L. Williams, and Mrs. Charles Young. Mrs. Eugene C. Bailey and Mrs. James Wognum were honorary escorts for all events.

Tea Dance

The tea dance was held on Monday, November 14, from 4:00 to 7:00 p.m. in the Gold Room of the Congress Hotel. The wives of the members of the Jubilee Hospitality Committee, assisted by members of the women's committee, greeted the guests as they entered. At the junction of the two tea tables, which were covered with gold lamé, a silver fountain sparkled, flanked on each side by stylized arrangements of Fiji chrysanthemums and blue grapes in gilded foliage, carrying out the Diamond Jubilee color motif. The following women poured at the tea: Mesdames Morgan, Barker, Karg, Cullimore, Miller, Allan, Lawler, Graser, Selby, Chapman, Rosenwald, Cunningham, Cowie, Parsons, and Bacon. Each lady who poured received a corsage of cymbidium orchids. The large group of guests enjoyed dancing to the music furnished by two orchestras.

President's Breakfast

On Tuesday morning, November 15, the National Board Breakfast and discussion were held in the Francis I Room at the Congress Hotel. After the National Board members assembled for an informal breakfast, Mrs. William E. Karg, president, called the meeting to order. After greeting the Board, she spoke seriously of the problem of stimulating greater interest in the scholarships, in order that everyone might more fully realize the importance and the needs of our Scholarship Funds. The sincerity and concern which Mrs. Karg showed, as she graciously presided, was deeply felt by all members present. The chairmen of the following Sections were present: Mrs. Theodore N. Graser, Boston; Mrs. Frank P. Lawler, Chicago; Mrs. Kenneth L. Selby, Cleveland; Mrs. Albert Chapman, Detroit; Mrs. Robert C. Allen, Milwaukee; Mrs. Robert Rosenwald, Minnesota. An informative and helpful discussion period followed in which ideas were exchanged on how to increase membership, how to stimulate interest in scholarships, and the various ways and means of raising scholarship funds. There is no doubt but that the enthusiasm engendered at this meeting will be of great assistance to us all.

Report on the Educational Funds

The Calvin W. Rice Scholarship Fund of $1500 has been awarded this year to Vasken Najarian of Lebanon. He is entered as a graduate student at the University of California at Los Angeles to study modern hydraulic machinery and equipment for hydroelectric-power projects. He also has been awarded a Tuition Scholarship of $390 by the University.

The Sylvia W. Farney Scholarship Fund of $500 has been awarded to each of two students: One to Carl G. Johnson, Northeastern University, Boston, Mass., and one to Roger L. Berkbigler, Missouri School of Mines and Metallurgy.

The Student Loan Fund continues to be quite active with 27 loans, amounting to $10,905, outstanding to students in 17 colleges.

Trip to Museum of Science and Industry

The women not attending the chairmen's breakfast were taken by bus to the Museum of

Science and Industry located far south along the outer drive. After viewing movies showing the actual capture of the German submarine, U-505, a tour was conducted through the submarine. Admiral Daniel V. Gallery, who was responsible for the capture of the U-boat, gave a short address. The group moved from reality to fantasy when they entered the world of make-believe—Colleen Moore's Doll House. Mrs. Roger J. Coleman, Colleen Moore's daughter, explained its history and told of interesting experiences while on national tour with the house. All will recall with pleasure the miniature gold coach, the exquisite ballroom of Cinderella fame with its heirloom pear-shaped diamond chandelier, and the delicate custom-made furnishings of alabaster, jade, and other precious materials. Mrs. William A. Dundas, chairman of all tours, which were complimentary, was ably assisted by Mrs. Carl E. Schmitz.

Annual Luncheon

The South Shore Country Club with its lovely grounds on the lake front was an ideal spot for the Annual Luncheon held on Tuesday, November 15, at 1:00 p.m. As the 306 ladies moved into the beautifully appointed dining room a table covered with gardenias and butterfly orchids presented an attractive picture. These were given to the out-of-town guests. Mrs. Donald J. Bergman and Mrs. Richard S. Hartenberg were in charge of the unusual floral arrangements and the special place cards which decorated the head table. Favors at each place included the printed luncheon program, mints, a packet of Philip Morris cigarettes, and hand lotion, through the courtesy of Jean Ferrell. The menu of the day featured breast of capon and coconut ice-cream snowballs with fudge sauce.

Mrs. Alexander Cowie, general chairman of Women's Activities, Diamond Jubilee Anniversary, presided. Special Honor guests on the dais were: David W. R. Morgan, retiring ASME President, and Mrs. Morgan; Joseph W. Barker, incoming ASME President, and Mrs. Barker; Mrs. William E. Karg, president, Woman's Auxiliary to ASME; the Honorable Ivy Baker Priest, Treasurer of the United States; Admiral and Mrs. Daniel V. Gallery; Mrs. Allan R. Cullimore, sponsor of the Chicago Section of the Auxiliary; and Mrs. Roger J. Coleman. Among others on the dais were: Mrs. Frank P. Lawler, auxiliary chairman, Chicago Section; and Mrs. James Wognum, wife of Chicago Section chairman. Mrs. Burgess Jennings was chairman of the Luncheon Committee and was assisted by: Mrs. Harry Boardman, Mrs. R. Dunham Cooper, and Mrs. David Frank.

After a greeting by Mrs. Cowie, Mrs. Karg was presented and gave the welcoming address. We were, indeed, honored to have Dr. Morgan and Dr. Barker with us, and doubly fortunate in having the privilege of hearing them speak. Their generous praise of the work of the Auxiliary and their hope for our ever-increasing service will be an inspiration to our organization. Mrs. Lawler then extended the welcome of the Chicago Section to the assembled guests. Admiral Gallery was persuaded to relate some of his experiences connected with the capture of the U-505. The dangers of such a decision, the hazards of boarding, the importance of the results, and the gallantry of his crew were fascinating to hear, especially as related in his unassuming manner. Mrs. Coleman answered some questions concerning the Doll House and told of its use in raising funds for charity. Mrs. Cowie then presented the Honorable Ivy Baker Priest who spoke to us on "Financial Engineering for Women."

Joseph W. Barker, ASME President, greets the Hon. Ivy Baker Priest who delivered the major talk at the Annual Luncheon of the Woman's Auxiliary to the ASME

The tremendous personal appeal, vitality, and magnetic personality of Mrs. Priest made her address one of the high points of the week's events. She first related humorous incidents in her every-day job and then spoke seriously of the world today and its indebtedness to the engineering profession. Then she asked us to visualize with her the mythical world of the woman of tomorrow, 2005 A.D., in which she believes women will play an ever-larger role in industry and government. She brought us to realize that the field of engineering is limitless and pointed out in numerous ways our responsibilities as wives of engineers. In closing she urged us to remember a nontechnical word, "free," with "e" for education, "e" for experience, "r" for responsibility, and all drawn together through "f" for faith.

At the close of the program a drawing was conducted for 25 charming door prizes. Mrs. Peter F. Vander Ploeg was chairman of the Prize Committee for all functions, assisted by Mrs. William H. Pletta, Mrs. E. B. Skubik, Mrs. E. J. Marslek, and Mrs. E. L. Hudson.

Diamond Jubilee Dinner and Calvacade

On Tuesday evening at 6:00 p.m. a Social Hour was held in the Williford Room of the Hilton Hotel for all ASME men and women. At 7:00 p.m. the group moved to the Grand Ballroom of the Hilton Hotel where dinner was served prior to the presentation of the Jubilee Cavalcade. This was an entertaining program portraying with music each decade of the Diamond Jubilee. The tremendous throng present enjoyed not only the entertainment, but also the opportunity to recall experiences of past days.

Annual Business Meeting

The annual business meeting of the Auxiliary was held Wednesday morning in the Buckingham Room of the Congress Hotel, with Mrs. Karg presiding. Mrs. U. A. Rothermel, first vice-president, and Mrs. George S. Gethen, corresponding secretary, were also seated at the front of the room. Mrs. Karg asked each officer or member to come forward to give her report, a kindness greatly appreciated by the capacity crowd of 110. Alex D. Bailey, past-president and Hon. Mem. ASME, brought a welcome to the group. Joseph W. Barker, ASME President, gave a brief address, "A Challenge to the Women." The ideas which he presented brought inspiration to the entire group. Reports were given by the Auxiliary officers, the chairmen of the standing committees, and the Section chairmen or their representatives.

It was a great privilege to have the following Auxiliary officers present: Mrs. U. A. Rothermel, first vice-president; Mrs. Robert W. Worley, second vice-president; Mrs. R. L. Thomas, fifth vice-president; Mrs. William H. Larkin, treasurer; and Mrs. George S. Gethen, corresponding secretary. Mrs. Harry R. Kessler, the Sponsor of the Honolulu, Hawaii Section, graciously presented its report, and Mrs. Crosby Field, Sponsor of the Southern California Section, presented one from that Section. The Auxiliary now has 19 Sections and a total membership of 1360. The chairmen or a representative of the educational funds also presented reports: Mrs. Allan R. Cullimore reported on the Calvin W. Rice Memorial Scholarship Fund; Mrs. Harry R. Kessler on the Student Loan Fund; and Mrs. Ralph L. Goetzenberger on the Sylvia W. Farney Scholarship Fund. All reports were interesting and radiated much enthusiasm.

The tellers of the election gave their report; the candidates proposed by the Nominating Committee were elected. The Officers for the coming year are: Mrs. William E. Karg, Philadelphia, Pa., president; Mrs. U. A. Rothermel, New York, N. Y., first vice-president; Mrs. Robert W. Worley, Philadelphia, Pa., second vice-president; Mrs. Theodore A. Wetzel, Milwaukee, Wis., third vice-president; Mrs. R. G. Roshong, Southern California, fourth vice-president; Mrs. Albert W. Eckstrom, Buffalo, N. Y., fifth vice-president; Mrs. Arthur M. Gompf, Baltimore, Md., recording secretary; Mrs. Milton Gershon, New York, N. Y., corresponding secretary; Mrs. William H. Larkin, New York, N. Y., treasurer; and Mrs. Gordon R. Hahn, New York, N. Y., assistant treasurer. After the annual business meeting was adjourned, the Nominating Committee held a short meeting.

Trip to the Board of Trade

After the business meeting the ladies were taken by bus to the Board of Trade Building. More than 100 took advantage of the unique experience of standing in the gallery and watching the trading taking place in the various grain pits below. Movies were then shown and a lecture on the operation of the Commodities Markets followed. The tour culminated in a ride to the observation tower for a bird's-eye view of the city.

Fur Fashion Show and Tea

At 2:30 p.m. on Wednesday, November 16, busses started leaving the hotel for the world-famous Pump Room of the Ambassador East Hotel, the scene of the Fur Fashion Show and Tea. Vogue pastel cigarettes, programs placed in attractive menu covers donated by Air France, and bottles of Suave, through the courtesy of Helene Curtis, were at each place. Waiters in scarlet and gold livery served an assortment of tea sandwiches and French pastries to the 215 guests. Nubians garbed in white-satin peplum-length coats, oriental pantaloons, and plumed turbines served coffee. The Chuck Cavallo string ensemble furnished the background music for the tea and the style show. Mrs. Frederick A. Faville, chairman of the day, extended a warm greeting to the guests. She then introduced Mrs. Cowie who presented Mrs. Karg, Auxiliary President, the other National Officers, and Mrs. Lawler, Chicago Section Chairman. Ruth McDevitt, star of the popular stage play, "Solid Gold Cadillac," presented a short skit. Maggie Daly, fashion consultant, did the commentary on the Fur Show, which was presented through the courtesy of the Uhleman Fur Company, celebrating their 80th anniversary this year. The exquisite and exciting furs were modeled by the following women of the Chicago Section: Mrs. John D. Coleman, Mrs. John Dolio, Mrs. Richard S. Hartenberg, Mrs. Adolph Langsner, Mrs. Edward A. Lauterbach, Mrs. E. B. Skubik, Mrs. Fred Stec, Mrs. Vern L. Stone, and Mrs. Thaddeus Zowski. Miss Beata Bergman, daughter of Mrs. Donald J. Bergman, and Mrs. Howard J. Eddy, daughter of Mrs. R. Dunham Cooper, also acted as models. At the close of the afternoon 25 prizes were awarded and, in addition, three lucky ladies received gift certificates of either 50, 35, or 25 dollars, courtesy of the Uhleman Fur Company. The members of the committee were: Mrs. L. D. Bechtel, Mrs. Gustaf Gaffert, Mrs. Alf Kolflat, Mrs. A. L. Mitchell, and Mrs. Edward Obert.

Tour of the North Shore

At 8:30 a.m. on Thursday, November 17, several bus loads of guests left the Congress Hotel for the North Shore Tour. The group traveled north on the Outer Drive, passed the Edgewater Beach Hotel, and Northwestern University Campus, to the Baha'i Temple in Wilmette. In a prominent location overlooking Lake Michigan, the nine-sided dome presents a spectacular picture. Erected of man-made stone, the lacy fretwork glistens in the sun. Each of the seven doors leading into the temple symbolizes one of the major religions recognized by the Baha'i Faith. The sections of the elaborate interior hung with priceless Turkish rugs were of especial interest to the group. Through a specially conducted tour of the Temple and movies, a summary of the religious philosophy of the faith was presented.

Luncheon and Opera

The ladies assembled at the Kungsholm Restaurant at 12:00 noon, and were served in Swedish smorgasbord style. The beautiful decor and elegant atmosphere of the Kungsholm added to our pleasure. Mrs. Cowie, as general chairman of the Diamond Jubilee Women's Committee, welcomed the ladies and presented the guests of honor: Mrs. William E. Karg, president, Woman's Auxiliary to the ASME; Mrs. David W. R. Morgan, wife of the retiring President, ASME; Mrs. Joseph W. Barker, wife of the President, ASME; Mrs. U. A. Rothermel, first vice-president; Mrs. Robert W. Worley, second vice-president; and Mrs. William H. Larkin, treasurer. Others on the dais were: Mrs. Frank P. Lawler, chairman of the Woman's Auxiliary to the ASME, Chicago Section; Mrs. James Wognum, wife of the chairman of the Chicago Section, ASME; and the Mesdames Parsons, Bacon, Vander Ploeg, Otte, and Mrs. M. V. Maxwell, chairman of the luncheon. Mrs. Frank Miller, past-president; Mrs. J. N. Landis, past-president; and Mrs. George S. Gethen, treasurer, were also presented. Mrs. Karg gave an appropriate address at this the final social event of the women's activities, and in a charming manner wished us not good-by but au revoir. Mrs. Lawler greeted the guests and expressed the pleasure we enjoyed in entertaining them here in Chicago. It was a pleasure to have an international table, and Mrs. Miller acted as hostess for: Mrs. R. E. Heartz, wife of the president of the Engineering Institute of Canada, Montreal, Canada; Mrs. S. T. Hoyt, Honolulu, Hawaii; and M. and Mme. C. J. Dubin of Paris, France. M. Dubin brought us greetings in French, and Mrs. Hoyt spoke on the cosmopolitan membership of our newest Section, Honolulu, Hawaii. At the close of the luncheon 35 prizes were awarded, and a rain hat in a Diamond Jubilee imprinted case was given to each of the 215 guests present. Members of the committee were: Mrs. G. W. Anderson, Mrs. M. L. Burgess, Mrs. Robert E. Coates, Mrs. John D. Coleman, Mrs. Paul A. Swaim, and Mrs. Thaddeus Zowski. Mrs. Ralph J. Hinch and Mrs. Vern L. Stone were in charge of tickets for all events.

The miniature grand-opera theatre at the Kungsholm, with its red plush and gilt decor was a delight. A short history of the theatre was given by Frederik Chramer, founder, and each lady received a souvenir program of "I Pagliacci," the opera presented. The recordings of famous opera stars and the skill with which the music students operated the exquisitely clothed and formed figures from below the stage, gave an illusion of size which beggars description. At the close of the performance, the women who wished to wait were given a conducted tour backstage. The puppets and miniature suites of period furniture from the 24 operas in the repertoire were viewed.

Final Continental Breakfast

The final breakfast gathering on Friday, November 18, in the Ladies' Headquarters in the Presidential Suite at the Congress Hotel, was both a happy and sad occasion. Old and new-found friends chatted and promised to see each other at the Annual Meeting next year in New York. It was with great reluctance that the Chicago ladies bade farewell to their guests, for they were very happy to be the hostess section. All members of the committees expressed the hope that the visitors returned to their homes with pleasant memories of this Diamond Jubilee Annual Meeting in Chicago.

Actions of the ASME Executive Committee

at a Meeting at Headquarters, Dec. 2, 1955

A MEETING of the Executive Committee of the Council was held in the rooms of the Society on Dec. 2, 1955. J. W. Barker, chairman, presided. In addition to Mr. Barker, there were present: F. L. Bradley, F. W. Miller, A. C. Pasini, of the Committee; H. J. Bauer (Finance), G. M. Muschamp (Organization), Joseph L. Kopf, treasurer, C. E. Davies, secretary, T. A. Marshall, Jr., assistant secretary.

Organization Committee

President Barker, former chairman of the Organization Committee, reported that the preliminary report on Aims and Objectives, prepared by the Organization Committee and discussed by the Council at the Chicago meeting, Nov. 13–14, 1955, had been sent to those who helped by replying to the Organization Committee questionnaire of March, 1955, and further suggestions were requested.

Research Committee on Fluid Meters

The Executive Committee voted to grant $3000 from the B-Development Fund to the Fluid Meters Research Committee for the preparation of the Manual on Methods of Computation of Flow Through Inferential Head Meters, this amount to be repaid from the sale of the publication.

Applied Mechanics Division

Approval was voted of a plan of the Applied Mechanics Division to establish a medal in honor of Prof. Stephen Timoshenko.

Students

The Executive Committee reviewed the action of the Council, on Nov. 13–14, 1955, on "strengthening the professional attitudes of students" and changed the action taken to read: "Each Faculty Adviser to be made a member of the nearest Section Executive Committee, *ex-officio, without vote.*"

Boiler and Pressure Vessel Committee

John D. Wilding, secretary of the Boiler and Pressure Vessel Committee, was directed by

the Executive Committee to travel to Spain with interim stops as necessary to provide staff service for the plenary meeting of ISO/TC-11.

Certificates of Award

Certificates of Award were granted to the following retiring chairmen of Boards and Committees:

S. W. Dudley, L. P. Hynes—Admissions Committee
E. W. Harrington—Constitution and By-Laws Committee
Charles T. Miller—Junior Committee
J. David Carr—Membership Development Committee
Adolph Ehbrecht—Membership Review Committee
J. W. Barker, G. W. Warren—Organization Committee
W. L. Cisler—Board on Public Affairs
P. L. Houser—Standardization Committee
R. B. Smith—Board on Technology

Certificates of Award were granted to the following retiring chairmen of Professional Divisions' executive committees:

N. J. Hoff—Applied Mechanics Division
Ray E. Small—Aviation Division
Carroll F. Hardy—Fuels Division
Alan Howard—Gas Turbine Power Division
H. B. Nottage—Heat Transfer Division
A. C. Stutson—Lubrication Activity
John Haydock—Machine Design Division
L. E. Newman—Management Division
Herbert H. Hall—Materials Handling Division
R. H. Tingey—Power Division
Gebhard C. Beck—Process Industries Division
E. W. Jacobson—Professional Division Committee
C. K. Steins—Railroad Division
L. A. Runton—Textile Division
R. D. Brooks—Wood Industries Division

A. C. Pasini, chairman, Nuclear Engineering Division, during its first-year organization period.

Alex D. Bailey member of the Nuclear Energy Application Committee, 1946–1955, and as a member of the Nuclear Engineering Division Executive Committee during its first-year organization period.

Certificates of Award were granted to the following retiring chairmen of Sections:

Floyd Smurr—Central Michigan Subsection
Erving Emmer—Cincinnati Section
George Derrickson—Westmoreland Section

Certificates of Award were authorized for the following past-chairmen of the Westmoreland Section:

R. V. Reynolds (1951–1952)
A. H. Moore, Jr. (1952–1953)
Philip Freneau (1953–1954)

American Rocket Society

With the understanding that the Board of Directors of the American Rocket Society had approved the co-operative agreement at its meeting in Chicago, Nov. 13, 1955, the Executive Committee of the Council voted to approve it. It was agreed at the meeting that two of the four ASME representatives on the ASME-ARS Joint Committee would be representatives of the Aviation and Gas Turbine Power Divisions.

Visit of Russian Engineers to U. S. A.

The Secretary reported that in accord with the request of Robert Murphy, acting secretary of the State Department, the Society had sponsored a visit of two Russian engineers to various facilities in the U. S. A. and had assisted the State Department in the organization of a corresponding team of U. S. A. engineers to visit Russia. The U. S. A. team (which left for Russia on December 4) consists of Nevin L. Bean, Ford Motor Company, Livonia, Mich., Weldon H. Brandt, Westinghouse Electric Corporation, East Pittsburgh, Pa., and Albert C. Hall, Bendix Corporation, Detroit, Mich.

Appointments

The Executive Committee noted the appointment of Edgar MacNaughton as presidential representative to Tufts University, First Academic Convocation, Medford, Mass., Dec. 8, 1955.

Candidates for Membership and Transfer in ASME

THE application of each of the candidates listed below is to be voted on after Jan. 25, 1956, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

New Applications and ●Transfers

Alabama

GAINES, WILLIAM L., Birmingham
JONES, ALFRED M., Huntsville

California

BOWEN, JOSEPH B., JR., Pasadena
DLOUHY, JOHN, San Mateo
●GRIFFITH, LEONARD F., Glendale
●HARRIS, ROBERT L., Berkeley
●LEPETICH, JOSEPH E., Los Altos
●MCANLIS, ROBERT G., Lompoc
OTTOSON, HANS L., Upland
●PERESICH, ALEX D., Ridgecrest
●WEITZMANN, ARTHUR L., Los Altos

Connecticut

HAMILTON, WESLEY D., Brookfield Center
HATCH, CLARENCE E., Hamden
MARBLE, RICHARD W., Uncasville
ROBINSON, JAMES A., Stamford

Delaware

COCHRAN, WAYNE A., Wilmington

District of Columbia

JAIN, JAGDISH S., Washington

Florida

GENTRY, AMBERS W., Pensacola
HARRINGTON, WEBSTER F., Jacksonville

Georgia

●MUZIO, ANDREW H., Newnan

Idaho

GRIFFITHS, JESSE J., Idaho Falls

Illinois

BELVILLE, R. M., Chicago
BLASKI, RICHARD B., Chicago
BROOKENS, DWIGHT M., Park Ridge
CARLSON, IRVING H., Chicago
CINELLI, JOHN J., Chicago
COSARO, RICHARD, Chicago
FORTY, DOMINIC, Chicago
GOTSCHEWSKI, PAUL O., Glenview
GREEN, WILLIAM L., Aurora
LEMPKE, ROBERT L., Park Ridge
LEVALLY, JOHN R., Chicago
MACMILLAN, CHARLES W., Rock Island
NELSON, HAROLD R., Chicago
O'BYRNE, STUART C., Chicago
PAUL, MURRAY J., Lombard

●Transfer to Member or Affiliate.

●RADICE, RICHARD V., Hazel Crest
REHNBERG, AXEL, Rockford
SMAARDYK, ABRAHAM, Clarendon Hills
SOSO, RICHARD P., Chicago
WAGNON, LEO A., JR., Evanston

Indiana

BERG, PAUL O., Fort Wayne
FALLON, JAMES A., Mishawaka
SMITH, RICHARD J., Valparaiso

Iowa

●GERSHUN, THEODORE L., Council Bluffs
●JENSEN, JAMES K., Cedar Falls

Kentucky

RODABAUGH, EVERETT C., Louisville

Louisiana

DAVIS, JOHN F., Baton Rouge
●PERRIN, FELICIEN, New Orleans

Maryland

BLACK, WALTER L., Baltimore
●VICKERY, STEWART R., Bel Air

Massachusetts

BRAGA, LEONEL E., Lexington
GRINNELL, SHERMAN K., Cambridge
MORGRAGE, FRANKLIN C., Milton
●SMITH, E. SHERMAN, Holyoke

Michigan

DAVIES, ROBERT, Detroit
DEMOSS, ROBERT W., St. Joseph
●JOHNSON, GEORGE A., Van Dyke
KURTTI, REUBEN, Jackson
●MAASS, ALBERT E., Saginaw
PALFEY, ALBERT J., Midland
●STEINMETZ, ARTHUR M., St. Joseph

Minnesota

ELM, ROBERT A., St. Paul
KENDRICK, GEORGE M., Minneapolis

Missouri

VERMET, WILLEM K., Kansas City

New Jersey

●BATCHELOR, ROBERT C., Glen Rock
●EGAN, EDWARD F., Somerville
●HARKER, JOHN S., Vineland
HERMAN, SHERMAN A., Nixon

New Mexico

●MCKIERNAN, JOHN W., Albuquerque

New York

BROOKS, ROBERT D., Ballston Lake
CARRIS, GEORGE T., Endicott
CASSINO, DONATO A., Jackson Heights
CHUN, VUNG-K., Bronx
CLOSE, WILLIAM W., Poughkeepsie
COLDEWEY, EDWIN W., Hicksville
● COPPOLA, SALVATORE E., Brooklyn
DEMARINIS, LEOPOLD P., New York

FREDERICK, JAMES E., Buffalo
FRITZ, ELLIOT L., Poughkeepsie
GRAF, HENRY R., Kenmore
HANFT, GEORGE J., Maspeth
●HILL, ROBERT R., Kenmore
KELLER, JOHN P., Schenectady
KOELLING, WOLFGANG H., Queens Village
MATRONE, JOHN L., Schenectady
MAYER, JOHN A., JR., Bronx
●MCINTOSH, ANDREW J., New York
MICHELS, WALTER J., Brooklyn
NAYMARK, SHERMAN, Scotia
POLLOCK, MICHAEL D., Floral Park, L. I.
SWEENEY, RICHARD J., New York
WASSERMAN, SEYMOUR, Bronx

Ohio

BLANK, JOHN M., Toledo
DEIST, ROBERT E., Waverly
HINES, JOHN D., Mt. Vernon
KUIVINEN, THOMAS O., Mt. Vernon
LOESCH, ROBERT C., Rocky River
MANNEY, JAMES D., Columbus
●ROSE, ANDREW H., JR., Cincinnati
SCHAUB, FREDERICK S., Mt. Vernon
SMALL, HERBERT A. B., Cleveland
●WRIGHT, JACK D., Mason

Oklahoma

STANLEY, CLYDE P., Tulsa

Oregon

●GENSMAN, LEE R., Tigard
MCKENZIE, FRANK W., Portland

Pennsylvania

BAYER, JULIUS L., Havertown
CABBLE, GEORGE M., JR., Wilmerding
CONAWAY, DONALD E., JR., Warren
CORL, WILEY F., JR., Wayne
CRAWFORD, CASPAR G., Philadelphia
●FERNANDES, JOHN H., Easton
GABRIELSEN, WILLIAM B., Bradford
JENNI, CLYDE B., Eddystone
KALSON, HYMAN, Pittsburgh
KENNEDY, GUY E., Gibsonia
LATHAM, ALBERT W., Pittsburgh
MITCHELL, WILLIAM R., JR., Erie
MYERS, JAMES W., Pittsburgh
OWEN, WILLIAM H., Lebanon
PASSMORE, LINCOLN A., JR., Haverford
POST, RICHARD, Philadelphia
WILDER, FRED D., Tyrone
WOLFENDEN, BRIAN K., Erie

Tennessee

BELL, EARL H., Knoxville
CLAY, WOODSON H., Lebanon
●MCDAVID, JAMES C., Kingsport

Texas

CLABAUGH, JACK H., Lake Jackson
MCALPIN, WILLIAM H., Dallas
MORRIS, MARVELL C., Houston
●ROLLINS, JAMES T., Midland
UNERFUSSER, JOHN F., Lake Jackson
WILLIAMS, RAYMOND, Port Arthur
WORLEY, GROVER L., Kermit

Washington

●WALLSTROM, LLOYD L., Seattle

West Virginia

PRING, CHARLIE C., Belle

Wisconsin

●EL-WAKIL, MOHAMED, Madison
●KOERPER, ERHARDT C., Milwaukee
ORAVETZ, JULIUS A., Racine
●THUERMAN, JOHN H., West Allis

Canada

ADDLEY, JOSEPH G., Walkerville, Ont.
LABISSONNIERE, ALFRED, Rosemount, Montreal
LEITH, WILLIAM C., Montreal
●MARK, CLAYTON, St. Catherines, Ont.
VAN DUYN, MARTIN, Peterboro, Ont.

Foreign

DUREUIL, ROBERT L., Paris, France
BELLO, JOSE L., Sao Paulo, Brazil
PEACOCK, JOHN, Kuwait, Asia
PEREZ-IZAGA, OSCAR J., Chiclayo, Peru
SEIDEN, HUGO, Kiryath Bialik, Israel

Transfers from Student Member to Associate Member 33

Engineering Societies Personnel Service, Inc.

THESE items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members or nonmembers, and is operated on a nonprofit basis.

In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office.

When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

New York	Chicago	Detroit	San Francisco
8 West 40th St.	84 East Randolph St.	100 Farnsworth Ave.	57 Post St.

Men Available[1]

Industrial Engineer, BSIE, single, veteran. Experienced in ordnance-inspection procedures, technical writing, production control, plant layout, general supervision, small electrical-parts production, transducer testing, guided-missile inspection. Prefers employment in small business. Me-278

Mechanical Engineer—Creative Engineer, over 15 years' responsible experience with nationally known corporation in the design, development, and sale of new products, processes, and production equipment. Outstanding record of accomplishments in the creation of practical and profitable new lines. Me-279.

Mechanical Engineer, M.I.T. graduate, 12 years' experience, principally manufacturing management. Textile, gun parts, electromechanical devices. Desires responsible position with commensurate salary and growth potential. Me-280.

Technical Executive, ME advanced degree, 20 years' experience. Can administer own group or assist top executive in program (or product) planning, design, development, or research. Strong in building and handling personnel. Light to heavy mechanical items and associated fields. Me-281.

[1] All men listed hold some form of ASME membership.

Positions Available

Engineers. (*a*) Design engineers, senior, mechanical graduates, minimum of five years' experience in machine-design work, preferably in fields where reciprocating parts are used. Should preferably have gun-design experience. $6000-$7000. (*b*) Technical assistant, engineering graduate, specific experience in the arms field; minimum of five years' experience in this field; also minimum of five years' experience in other engineering fields. Should have some administrative ability with potential to become a section head, and eventually advance to department manager. $7600-$9000. (*c*) Mechanical engineer, for research and development work on powder-actuated tools. Experienced in the design of operating mechanisms; working knowledge of production equipment and methods. Familiarity with firearms helpful. $6000-$8400. Must be U. S. citizens. Conn. W-2463.

Project Engineer, mechanical engineer or physicist, five to ten years' experience, for design and development of mechanical or electromechanical mechanisms in the field of military ammunition: Projectiles, fuses, training devices, weapon systems. $6000-$7000. Conn. W-24-64(*a*).

President for large company engaged in manufacturing of heavy farm equipment. Experience necessary in marketing, finance, and manufacturing of heavy equipment. $40,000. Midwest. W-2483.

Senior Industrial Engineers, 27-35, BSIE, IM, or ME, four to six years' experience in heavy industry such as basic steel, fabrication, rolling mill. Experience in plant layout, methods, cost reduction, time study, or production standards for work in this field. Salary open. W. Va. W-2495.

Engineers. (*a*) Design analyst, BSME, engineering mechanics, physics, or math, at least two years' experience in stress and vibration analysis, to investigate stress conditions in machine parts. Design parts to withstand applied loads; analyze dynamics of machines; analyze vibrations in machines. Design machines to eliminate detrimental vibration, both torsional and translational. (*b*) Design engineer, internal-combustion engines, mechanical graduate, knowledge of mechanical engineering, five or more years' recent experience in design of diesel or gas engines, to develop the design of portions of an internal-combustion engine; review necessary changes to insure new engine designs will perform properly; assist in calculations and analysis to determine proper general design of engines to conform to specifications. N. Y. State. W-2505.

Engineers. (*a*) Application and development engineer, internal-combustion engines, mechanical graduate, five or more years' recent experience in development and application work on gas or diesel engines, to investigate application of gas engines or gas-engine-driven compressors to special requirements; conduct tests of gas engines and gas-engine-driven compressors, etc. (*b*) Senior design engineer, internal-combustion engines, mechanical graduate, ten or more years' recent experience in designing diesel or gas engines; five or more years' in charge of and responsible for major engineering programs of considerable significance. Organize, calculate, and analyze general-design objectives suggested by chief engineer and develop own ideas into specific proposals for development projects. Review necessary changes to projects to insure new design performs properly. N. Y. State. W-2506.

Project Engineer, mechanical graduate, five years' experience, with minimum of one year as a machinery designer, or one year in the pulp and paper industry. Responsible for design of various machines, components, and mechanisms and make the necessary analysis and calculations connected herewith. $6500-$7500. Mass. W-2517.

Assistant Plant Manager, 36-45, degree, eight to ten years' experience in rolling operations, preferably of aluminum foil, to eventually assume plant managership over foil-plant operations, including rolling foil stock to specified thickness, annealing, spooling, and slitting to packaging and shipping. Salary open. Calif. W-2534.

Engineers. (*a*) Design engineer, at least ten years' printing-press, automatic, or special machinery experience. $8000-$10,000. (*b*) Senior draftsman, at least five years' supervisory layout experience on machinery. $6000-$7000. (*c*)

(*ASME News continued on page 126*)

this is "life insurance" for boilers

It's a good "policy" to protect your valuable boilers with YARWAY Boiler Level Indicators.

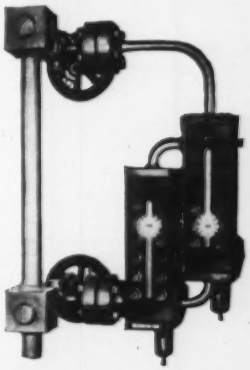
Instant . . . accurate . . . continuous remote readings of boiler water levels are available on the instrument panel or wherever you wish in the plant.

YARWAY's new "wide vision" face gives brilliant readings from any angle . . . and the pointer is always visible, even at extreme high and low water levels.

For brilliant "shines like a star" readings on the boiler drum you'll want to use YARWAY Flat Glass Gages with Type "M" Illuminators.

From drum to panel and at all remote locations, YARWAY equipment gives you the safest boiler protection you can buy—proved beyond doubt in nearly 10,000 installations.

◀ Yarway Remote Liquid Level Indicator. Write for Yarway Bulletin WG-1824.



Yarway Flat Glass Water Gage with Type "M" Illuminators. Write for Yarway Bulletin WG-1812. ▶

YARNALL-WARING COMPANY
108 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY steam plant equipment

Detail draftsman, machinery experience. $4000-$5000. Newark, N. J., area. W-2544.

Engineers. (*a*) Design engineer, mechanical, minimum of two to four years' experience in the mechanical design of steam turbines or similar equipment. Capable of handling critical-speed problems, stress analysis, etc. Familiar with design of turbine blading. Duties include original mechanical design of gas-turbine components. $7200-$9600. (*b*) Design-manufacturing engineer, mechanical, minimum of five years' experience in design of gas or diesel engines and/or reciprocating compressors; similar experience in the manufacture of this equipment with some experience in cost accounting and cost methods. Work closely with design, manufacturing, and cost group. $7200-$10,800. (*c*) Design field-service engineer, mechanical, heavy experience in the field of gas or diesel-engine design. Experience on reciprocating compressors. Background of experimental and development work on gas and diesel engines with some experience with field problems. Will co-ordinate design problems between engineering group and field service. $6000-$10,800. Upstate N. Y. W-2554.

Chief Mechanical Engineer, graduate, 40-50, to take charge of the design and construction of a large steam-power plant. Must have administrative background. $15,000, plus bonus. New York, N. Y. W-2564.

Engineers. (*a*) Senior industrial engineer, at least ten years' supervisory experience covering time studies, standards, methods, and production. $8000-$9000. (*b*) Junior industrial engineer, IE graduate, for time studies and methods. $5000-$6000. (*c*) Quality-control engineer, machine-shop inspection and production experience. $6000-$8000. Northern N. Y. W-2584.

Gear Engineer, mechanical graduate, for research and development work on gears, gear trains for both commercial and high precision work. Salary open. Mass. W-2587.

Editor, 25-30, graduate mechanical, with one or two years' experience with an electric-utility or a consulting-engineering firm in the electric-utility field. Will specialize in generation problems. One quarter of time will be spent in travel. Salary open. Headquarters, New York, N. Y. W-2602.

Mechanical Engineer, rubber or plastics background. Someone who can act as trouble shooter and be able to take new products through the various development stages to manufacture. Salary open. Calif. W-2604.

General Manager, at least ten years' managerial and production experience supervising building-products mill, including wall board and insulation materials, to take charge of wood-waste products plant. Salary open. East. W-2608.

Industrial Engineer, IE degree or ME degree with an IE option, minimum of five years' varied experience, for major investigations culminating in full recommendation in all phases of company operations, both manufacturing and office; full methods and production studies; departmental operations; materials-handling methods; job evaluation and salary administration; statistical analysis as required; future development of incentive coverage. $7200-$8400. Conn. W-2610.

Quality-Control Electronic Engineer, 25-35, for radar, fire-control, communication, navigation, design-test equipment, set up and direct lab personnel in test procedures. $8500. N. Y. metropolitan area. W-2612.

Industrial Engineer, 35-45, experience covering time study, methods, tooling, wage incentive, and cost reduction for N. Y. consulting firm. Initial assignment, Chicago. $8000-$10,000. Headquarters, New York, N. Y. W-2614.

Engineers. (*a*) Assistant secretary, mechanical graduate, under 35, with some knowledge of heating, air conditioning, refrigeration, air cooling, etc., to work with society's sections, membership, etc. Some ability to write desirable. Some travel. Salary open. (*b*) Assistant technical secretary, mechanical graduate, young, for editorial work on magazine and handbook. Should have had some experience in heating, air conditioning, etc. Some travel. Salary open. East. W-2617.

Engineers. (*a*) General manager, cylinder-gas sales division, for company engaged in the sale of industrial gases, including oxygen, nitrogen, argon, hydrogen, helium, and special mixtures. Must have management qualifications with a sales background, particularly in the industrial gas field. About $12,000. (*b*) Plant sales coordinator to assist the sales-department staff in correspondence with customers on contracts and and projects, handling routine inquiries and quotations. Should have sales interest and be a good detail man. Should have technical background. About $7200. Pa. W-2623.

Industrial-Relations Manager, 35-45, graduate engineer, some law-school and business-school training. Should have some experience in union labor negotiations for large multiplant heavy-equipment manufacturer. To $20,000. Headquarters, New York, N. Y. W-2642.

Design Engineer, graduate mechanical, capable of designing; also design supervision of heavy machinery such as used by metallurgical, cement, chemical, and process industries. To start, $6000-$9000. Southeastern Pa. W-2655.

Methods Supervisor, industrial or mechanical graduate, 30-40, at least five years' experience in methods in procurement work, work simplification, or M.T.M. Will supervise methods improvements and training of foreman and time-study men in time studies. Company manufactures household appliances. $7200. Mich. C-4080.

Chief Engineer, mechanical graduate, 35 or over, at least ten years' experience in design and development of paper-converting machinery. Should have knowledge of high-speed automatic machinery. Will take complete charge of engineering department on design and development of paper products and paper-converting machinery. Must have demonstrated executive ability. To $20,000, depending upon experience. Employer will negotiate placement fee. Chicago, Ill. C-4092.

Assistant Superintendent, 35-55, at least five years' experience in welding of alloys and preferably stainless steels. Should have knowledge of fixtures and welding engineering. Will assist superintendent of job-shop fabricating and welding stainless steel and other alloy products ranging into large, heavy tanks. $7000-$9000. Employer will pay fee. Chicago, Ill. C-4098.

Mechanical Engineer, graduate, 20-34; experience in hydrodynamic lubrication research desirable but not essential. Research-apparatus design experience also desirable. Will carry out basic research on design of journal bearings to perform unusual conditions such as limited oil supply with organic liquids of low viscosity, high temperatures, very high speeds. $4800-$7800. Employer will pay fee. Ohio. C-4137.

Chief Production Engineer, mechanical graduate, 35-45, knowledge of wood and steel manufacturing. Will supervise project engineers, processing, automation, trouble shooting. Conveyerizing, redesign of product for cost reduction, parts drawings, taking product from product engineering and putting it into manufacture. Some travel. $10,000. Employer will pay fee. Wis. C-4173.

Manufacturing and Installation Engineer, BS, to 45, at least three years' experience in production and manufacturing engineering, to work on sheet-metal or plate-steel work. Should know oil burners and combustion. Will supervise 20-25 men, handling production engineering, routing, and field installation of equipment on industrial and commercial oil burners, boilers, and allied equipment. $7000-$7500. Employer will negotiate fee. Calumet District, Ill. C-4183.

Instrument and Efficiency Engineer, at least six years' experience in general power-plant work of 200 psi or higher steam pressure. Knowledge of test and efficiency work and power-plant instruments. Will check and calibrate all instruments, supervise maintenance of instruments, conduct efficiency tests, check temperatures of coal piles, supervise coal testing and sampling, eliminate smoke, and make recommendations for improvements. $5700-$8400. Ill. C-4188.

Lubrication Engineer, experienced in setting up and administering lubrication systems in manufacturing plant. Will set up and administer a lubrication system for a printing company covering presses, binding machines, and other equipment. $5800-$8000. Chicago, Ill. C-41-89.

Machine-Research Engineer, mechanical graduate, 28-38, at least five years' experience in development or design of packaging and materials-handling machinery. Will have supervisory responsibility over drafting and machine-shop employees working on projects improving present machinery and development of new machinery. Company is manufacturer of paper. $8000-$12,000. Chicago, Ill. C-4211.

Research and Development Engineer, mechanical graduate, 30-45, two to three years' experience on heavy machinery. Should have a knowledge of paper-pulp and textile machinery. Will develop new products, modernize or modify existing products. Some travel. $7800-$8400. Employer will negotiate fee. Wis. C-4240.

Assistant Production-Control Manager, industrial or mechanical graduate, 28-38, at least three years' experience in job-shop operations, if possible. Should have knowledge of stamping, etching, welding, and buffing and finishing operations. Will analyze production problems and later develop and help on administrating production-control system under production manager. $6000-$8000. Employer will negotiate fee. Chicago, Ill. C-4242.

Chief Design and Development Engineer, mechanical graduate, at least five years as chief design and development engineer on light, fast-moving, automatic machinery. Will supervise the installation and direction of all machine design and development activities. For manufacturer of paper products. $10,000-$12,000. Chicago, Ill. C-4245.

Obituaries

Alexander Russell Cochran (1887-1955), retired vice-president of Fajardo Sugar Co., Canovanas, Puerto Rico, died Feb. 11, 1955. Parents, Samuel R. and Helen (Houton) Cochran. Education, attended Collegiate School, Glasgow, Scotland, for six years. Married Beatrice Thomes, 1915. Assoc-Mem. ASME, 1922; Mem. ASME, 1935. Survived by wife; children, Alexander Russell, Jr., John Thomes, and Helen Cochran Wearin.

Richard Francis Deimel (1881-1955), retired head of department of mechanical engineering, Stevens Institute of Technology, died Sept. 28, 1955. Born, New York, N. Y., June 27, 1881. Parents, Francis and Wilhelmine Deimel. Education, BS, The College of the City of New York, 1902; MA, Columbia University, 1903. Married Christine Schwarje, 1906. Held patents on his invention of latitude adjustment for gyrocompass and automatic averager for sextants. Author of "Mechanics of the Gyroscope," 1929. Received honorary degree of Doctor of Engineering from Drexel Institute, 1945. Received honorary degree of Doctor of Science from Stevens Institute of Technology on his retirement in 1952. Mem. ASME, 1929. Survived by wife and a daughter, Dr. Dorothea Vann of Englewood, N. J.

Joseph B. Ennis (1879-1955), retired senior vice-president, American Locomotive Co., New York, N. Y., died Sept. 22, 1955. Born, Wortendyke, N. J., May 29, 1879. Parents, William C. and Kate (Burroughs) Ennis. Education, attended high school. Married Lillian R. Jersey, 1903. Awarded Henderson Medal by The Franklin Institute, 1944. Received an honorary Doctor of Engineering degree from Clarkson College of Technology, 1945. Mem. ASME, 1909; Fellow ASME, 1945. Survived by daughter, Mrs. R. Tom Sawyer and two grandchildren.

Gerard Post Herrick (1873-1955), president, design department, Convertoplane Corp., New York, N. Y., died Sept. 9, 1955. Born, New York, N. Y., Jan. 23, 1873. Parents, Elias J. and Margaret (Post) Herrick. Education, AB, Princeton University, 1895; LLB, New York Law School, 1897. Married Lois Hall, 1919. Received a plaque as "father of convertible aircraft" from the Institute of Aeronautical Sciences and the American Helicopter Society, 1949. Mem. ASME, 1939. Survived by wife; a son, Scott Hicks Herrick; and a daughter, Mrs. Lloyd Waterman Cornell, Jr.

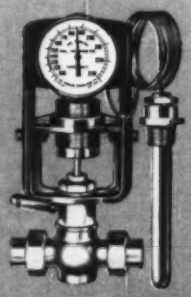
Harry Francis Kellogg (1878-1955), president and treasurer, Central Screw Co., Chicago, Ill., died sometime in 1955. Born, Providence, R. I., Nov. 7, 1878. Parents, John S. and Emma C. Kellogg. Education, ME, Brown University, 1901. Married Gertrude L. Whipple, 1903. Mem. ASME, 1934.

Karl Knohl (1906-1955), design engineer Cooper-Bessemer Corp., Mt. Vernon, Ohio, died sometime in 1955. Born, Wuppertal, Barmen, Germany, Oct. 28, 1906. Education, BS, State Technical College, Elberfeld, Germany, 1928. Assoc. Mem. ASME, 1954.

Arthur H. Krauss (1895-1954), mechanical engineer, Ebasco Services Inc., New York, N. Y., died Dec. 16, 1954. Born, New York, N. Y., Nov. 20, 1895. Parents, John G. and Emma Krauss. Education, ME, Stevens Institute of Technology, 1916. Married Dorothy Raynor, 1919; children, Janet and Kenneth. Jun.

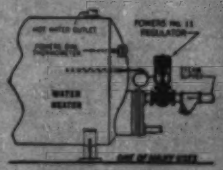
(*ASME News continued on page 128*)

WHY POWERS No. 11 REGULATORS Give BETTER CONTROL and Last Longer



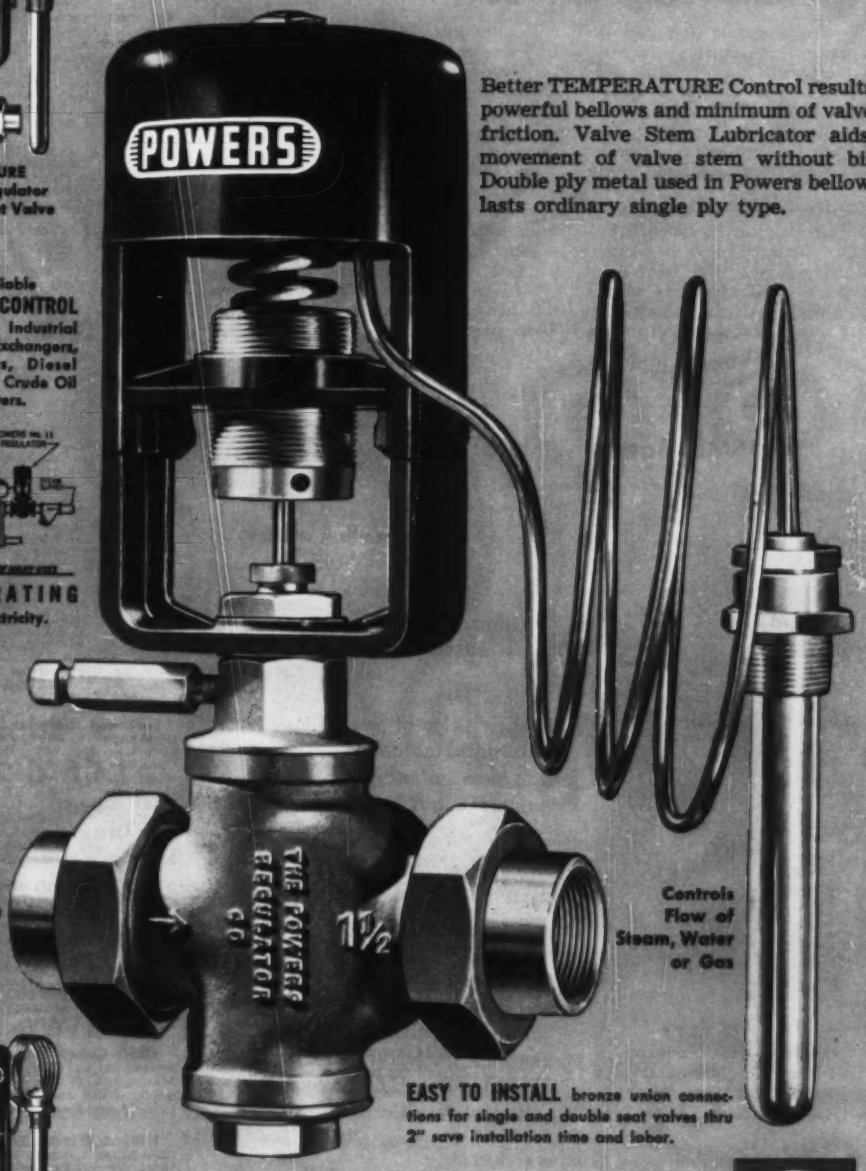
TEMPERATURE Indicating Regulator with Single Seat Valve

Simplest, Reliable **TEMPERATURE CONTROL** made for: Many Industrial Processes, Heat Exchangers, Air Compressors, Diesel Engines, Fuel and Crude Oil Heaters and Treaters.



SELF OPERATING Needs no Electricity.

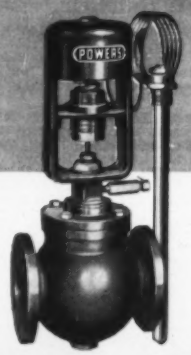
Better TEMPERATURE Control results from powerful bellows and minimum of valve stem friction. Valve Stem Lubricator aids easy movement of valve stem without binding. Double ply metal used in Powers bellows outlasts ordinary single ply type.



Balanced (Double Seat) Valve

Controls Flow of Steam, Water or Gas

EASY TO INSTALL bronze union connections for single and double seat valves thru 2" save installation time and labor.



(c44)

Above: Flanged Iron Body Valve with Double Seat for sizes above 2"

● **15 to 20 Years of reliable service** is often reported by users of Powers Temperature Regulators. Since 1891 they have been noted for their sturdy construction and dependability.

● Right type of Regulator and the right size valve is important for best control. From Powers complete line of self operating regulators and air operated temperature controllers you can be sure of getting the type best suited for your requirements. Call our nearest office or write us direct. 3400 Oakton St., Skokie, Illinois. Offices in Chief Cities.

POWERS CONTROL

Since 1891

THE POWERS REGULATOR COMPANY

ASME, 1920; Assoc.-Mem. ASME, 1923; Mem. ASME, 1935.

Harry Peter Lawrence Laussucq (1888-1955), manager, Hydraulic Dept., Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., died Aug. 24, 1955. Born, Pau, Basses Pyrenees, France, July 8, 1888. Parents, Jules C. and Marie Catherine (Lazaret) Laussucq. Education, attended Pau High School, Pau, Basses Pyrenees, France. Naturalized U. S. citizen, Camden, N. J., 1917. Married Helen Tyler, 1914. Held patent on hydraulic press controls; special processes for manufacture of insulating and hard boards. Mem. ASME, 1921. Survived by wife and a son, Harry Peter Lawrence Laussucq, Jr.

Keep Your ASME Records Up to Date

ASME Secretary's office in New York depends on a master membership file to maintain contact with individual members. This file is referred to dozens of times every day as a source of information important to the Society and to the members involved. All other Society records and files are kept up to date by incorporating in them changes made in the master file.

From the master file are made the lists of members registered in the Professional Divisions. Many Divisions issue newsletters, notices of meetings, and other materials of specific interest to persons registered in these Divisions. If you wish to receive such information, you should be registered in the Divisions (no more than three) in which you are interested. Your membership card bears key letters opposite your address which indicate the Divisions in which you are registered. Consult the form on this page for the meaning of the letters. If you wish to change the Divisions in which you are registered, please notify the Secretary's office.

It is important to you and to the Society to be sure that your latest mailing address, business connection, and Professional Divisions' enrollment are correct. Please check whether you wish mail sent to home or office address.

For your convenience a form for reporting this information is printed on this page. Please use it to keep the master file up to date.

ASME Master-File Information

(Not for use of student members)

Please print **Check mailing address**

Name ..... (Last, First, Middle)

Home address ..... ☐ (Street, City, Zone, State)

Name of employer .....

Address of employer ..... ☐ (Street, City, Zone, State)

Product or service of company .....

Title of position held .....

Nature of work done .....

I am a subscriber to (please check)

Publication	*Address changes effective when received prior to:*
☐ Mechanical Engineering	10th of preceding month
☐ Transactions of the ASME	20th of preceding month
☐ *Journal of Applied Mechanics*	20th of preceding month
☐ *Applied Mechanics Reviews*	1st of preceding month

Please register me in three Professional Divisions as checked:

☐ A—Aviation	☐ J—Metals Engineering	☐ R—Railroad
☐ B—Applied Mechanics	☐ K—Heat Transfer	☐ S—Power
☐ C—Management	☐ L—Process Industries	☐ T—Textile
☐ D—Materials Handling	☐ M—Production Engineering	☐ V—Gas Turbine Power
☐ E—Oil and Gas Power	☐ N—Machine Design	☐ W—Wood Industries
☐ F—Fuels	☐ O—Lubrication	☐ Y—Rubber and Plastics
☐ G—Safety	☐ P—Petroleum	☐ Z—Instruments and Regulators
☐ H—Hydraulics	☐ Q—Nuclear Engineering	

Frederick Charles Lindemann (1923-1955), consultant engineer, Milwaukee, Wis., died Aug. 4, 1955. Born, Milwaukee, Wis., June 16, 1923. Parents, Walter C. and Jeanette (Wachsmuth) Lindemann. Education, BS, Yale University, 1945; ME, University of Wisconsin, 1948. Married Jean Schmidt. Received Silver Star and Distinguished Flying Cross, U. S. Army. Jun. ASME, 1948. Survived by wife; three children, Heidi, Julianna, and Christian.

Charles A. Pratt (1868-1955), vice-president, Goodman Manufacturing Co., Chicago, Ill., died in August, 1955. Born, Toledo, Ohio, July 28, 1868. Education, attended University of Michigan. Mem. ASME, 1927.

William A. Schuyler (1883-1955), owner, Firm of W. A. Schuyler, New York, N. Y., died sometime in 1955. Born, Zurich, Switzerland, June 22, 1883. Education, attended Technical School, Zurich, Switzerland. Assoc-Mem. ASME, 1921; Mem. ASME, 1935.

Ralph Emmett Smith (1907-1955), former chief marine engineer, Hawaiian Steam Ship Co., New York, N. Y., died June 26, 1955. Born, Braddock, Pa., Aug. 29, 1907. Education, EE, University of California; ME, University of Wyoming. Mem. ASME, 1947. Survived by wife, Helene; two children, Kaye and Scott.

Hubert de Laserre Spence (1890-1955), assistant chief engineer, National Masseable & Steel Castings Co., Cleveland, Ohio, died sometime in 1955. Born, Cleveland, Ohio, July 5, 1890. Parents, Hubert de L. and Frances (Chapin) Spence. Education, BS, Case School of Applied Science, 1913; ME, Case School of Applied Science, 1928. Married Lorna Slater, 1915; children, a son, Richard Slater Spence. Held patents on draft gear, coupler yoke, and grate bar. Mem. ASME, 1930.

Arthur Knowlson Spotton (1874-1950), advisory engineer, Babcock-Wilcox & Goldie-McCulloch, Ltd., Galt, Ontario, Can., died sometime in 1950. Born, Barrie, Ontario, Can., March 22, 1874. Parents, Henry B. and Ann (Kew) Spotton. Education, Diploma in Engineering, University of Toronto, 1894. Married Ethel E. Insole, 1910. Jun. ASME, 1906; Mem. ASME, 1921.

Lockwood Northcott Street (1890-1955), electrical engineer, Solvay Process Co., Hopewell, Va., died May 26, 1955. Born, Caledonia, Ontario, Can., Dec. 5, 1890. Parents, Jacob R. and Rose (Northcott) Street. Education, AB, Syracuse University, 1912; EE, Syracuse University, 1914. Naturalized U. S. citizen, Syracuse, N. Y., 1905. Married Marion Louise Dexter, 1926; three children, Kathyrn Louise, Lockwood Dexter, and Virginia Tisdale. Assoc-Mem. ASME, 1923; Mem. ASME, 1935.

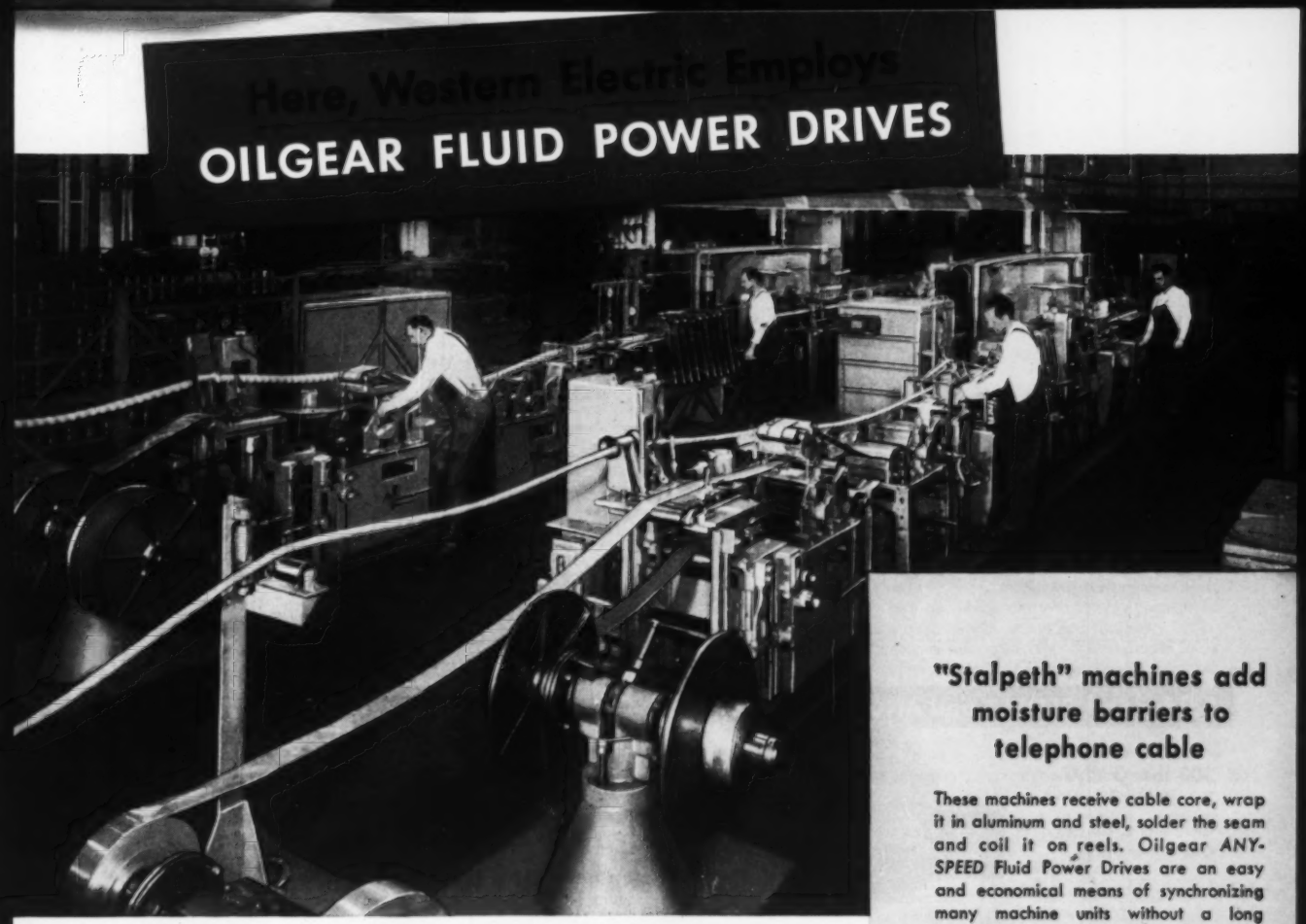
Hugh Campbell Thuerk (1896-1955), executive vice-president, New Jersey Power and Light Co., Dover, N. J., died Oct. 5, 1955. Born, Buffalo, N. Y., April 6, 1896. Parents, Henry J. and Susie (Campbell) Thuerk. Education, BS, Purdue University, 1919; MS, Purdue University, 1922. Married Ferol Louise Bull, 1921. Author of several papers. Assoc.-Mem. ASME, 1929; Mem. ASME, 1933. Survived by wife; a son, Hugh; two daughters, Mrs. R. C. Howland and Mrs. J. K. Avery, and seven grandchildren.

Albert Cooley Townsend (1874-1955), retired mechanical engineer, died Aug. 4, 1955. Born, Matteawan, N. Y., May 17, 1884. Education, public school and apprenticeship. Jun. ASME, 1910; Assoc-Mem., 1918; Mem. ASME, 1926.

William Harvey Tschappat (1874-1955), retired Major General, U. S. Army, died Sept. 22, 1955. Born, Bealsville, Ohio, Aug. 10, 1874. Parents, Philip and Catherine (Kinzey) Tschappat. Education, BS, United States Military Academy at West Point, 1896. Married May Alice McCrea, 1898. Hon. Mem. ASME, 1938. Survived by wife.

Stephen Allen Waldman (1903-1955), senior production engineer, Consolidated Edison Co., New York, N. Y., died March 7, 1955. Born, Prague, Czechoslovakia, May 15, 1903. Parents, John and Frances (Matyas) Waldman. Education, BS, New York University, 1924. Married Matilda C. Voska. Jun. ASME, 1948. Survived by wife and a daughter, Joyce Ann.

Here, Western Electric Employs OILGEAR FLUID POWER DRIVES



Solving the problem of close synchronization of driven members

As machines become more and more complex, combining more and more functions into a single unit, the problem of driving these machines successfully becomes more difficult.

This problem confronted Western Electric Company engineers in designing what they call their "Stalpeth" machines, two of which are shown above. These machines combine corrugating of steel and aluminum strips, forming them around the cable core, soldering the seam and then winding the assembly on reels at the far end. All of the members of the machine must be synchronized to the speed of the capstan unit. Going by their experience with other somewhat similar machines, Western Electric engineers again turned to Oilgear *"Any-Speed"* Fluid Power Drives, to solve what is really a complex problem ordinarily. Oilgear units provided an easy and economical means of synchronizing many machine components.

Oilgear *Any-Speed* Fluid Power Drives and transmissions *do* offer many machine design advantages including ease of control and synchronization of driven members, steplessly variable speed, fundamentally simple circuits, and long, trouble-free life. Write for Oilgear drive bulletins. THE OILGEAR COMPANY, 1570 W. Pierce St., Milwaukee 4, Wisconsin.

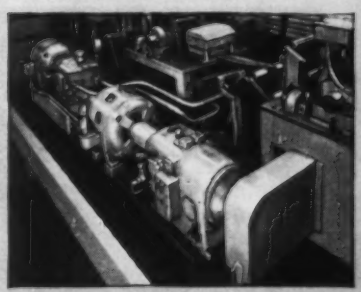
OILGEAR
Fluid Power

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

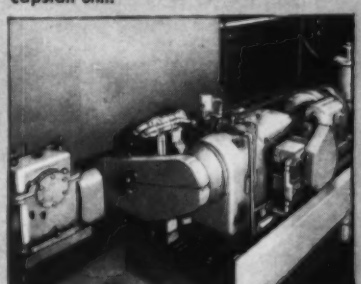
PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES

"Stalpeth" machines add moisture barriers to telephone cable

These machines receive cable core, wrap it in aluminum and steel, solder the seam and coil it on reels. Oilgear *ANY-SPEED* Fluid Power Drives are an easy and economical means of synchronizing many machine units without a long lineshaft.



These Oilgear *ANY-SPEED* units drive the aluminum and steel corrugator units in perfect unison with the governing capstan unit.



The Oilgear *ANY-SPEED* capstan drive. Not shown here is another Oilgear unit driving the cable winding reels.

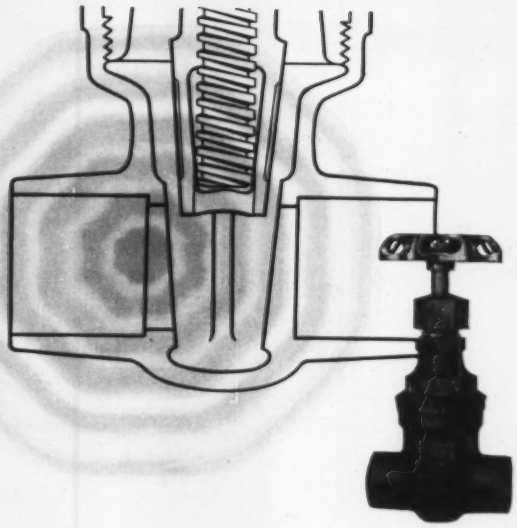
When the heat's on

you need the extra strength of

JENKINS

Solder and Socket End

VALVES



Solder End GLOBES and ANGLES

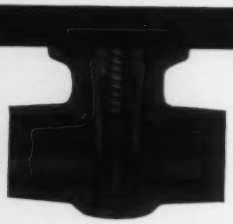
300 lbs. O.W.G.
¼" to 3"

Fitted with Renewable Composition Disc.

Solder End GATES

225 lb. and 300 lb. O.W.G.
⅜" to 3"

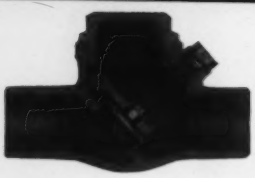
With solid or split wedges, and stationary or traveling spindles.



Solder End CHECKS

300 lbs. O.W.G.
¼" to 3"

Regrinding. May be easily reground without removal from line.



NEW BULLETIN Lists all Jenkins Solder End and Socket End Valves and gives complete instructions for soldering and brazing. Ask for Solder-Socket End booklet.

The "light-duty" look of copper tubing installations is deceiving. Valves must provide an accurate fit to tubing and *hold it* under the intense heat of soldering. And, because flexible tubing does not afford the rigid support of standard pipe, valves must withstand unusual strains in operation.

Jenkins Solder End Valves are engineered to meet these demands with strength to spare. High tensile bronze castings have liberal dimensions for extra rigidity. Smooth, clean bores assure accurate fit, easy soldering, positive seal to types K, L, and M Copper Tubing.

For faster, trouble-free installation, and lasting economy, specify Jenkins Solder End Valves. Jenkins Bros., 100 Park Ave., New York 17.

JENKINS Socket End Valves

for Class B or IPS Tubing

Jenkins bronze valves with socket ends for silver-brazing are made in Globe, Gate, and Swing Check patterns to control compressed air, hot oil, and similar fluids in tubing hookups where specifications call for permanent, leakproof joints. Complete information in the Bulletin offered below.

JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS

KEEP INFORMED

NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

Available literature or information may be secured by writing direct to the manufacturer. Please mention MECHANICAL ENGINEERING.

NEW EQUIPMENT

Fast-Dry Enamel

A new line of fast-drying synthetic finishes for manufacturers of heavy equipment such as farm and road machinery and machine tools is being introduced by the Du Pont Co., Finishes Div., Wilmington, Del.

Named 113-Line fast drying finishes, the pigmented enamels in most colors set up so rapidly, the ware can be handled in about 15 min, the company says. Even reds and blacks only need up to 30 min to set up. The material is tack-free in 2 to 3 hr.

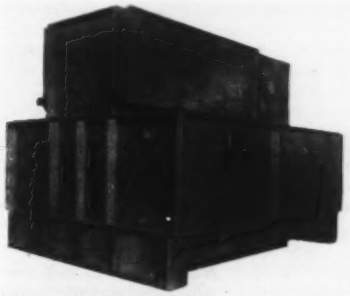
In addition to the fast dry feature, the new finish has excellent adhesion applied directly to solvent cleaned metal. Superior resistance to gasoline and oil is claimed, and flexibility, water-resistance, and general durability are rated as good.

Sleeve Valve Engine

Vard, Inc., Pasedena 8, Calif., announces the development of a five-cylinder sleeve valve type engine designed for use on small helicopters, flying platforms and low-speed target drone applications.

The four-cycle powerplant pictured here is under test on a dynamometer test stand. In this stage of development, the company says, the engine is producing 64 hp at approximately 6000 rpm.

The engine is symmetrical, with exhaust and intake ports being identical. By rotation of the sleeve cranks, left- or right-handed rotation can be accomplished, the company points out.



Sectional Condenser

A new design, evaporative-type refrigerant condenser in capacities ranging up to 240-ton ammonia refrigeration is announced by the Niagara Blower Co., 405 Lexington Ave., New York 17, N.Y.

The refrigerant is condensed in two parallel mounted coils enclosing a central plenum under the fan section. Water sprays are arranged over the coils and the air enters from above, travels downward and changes direction to enter the plenum, at which point the entrained water is eliminated. The air then moves up and out through propeller fans.

The hot gas is subcooled before condensation by first passing through duo-pass precooling coils mounted beside the fan section. A dry air stream crosses this coil, removing the superheat. Any oil vapor present is liquefied during this process and removed by the separator in the gas line ahead of the condensing coils. This precooling also prevents the high-temperature deposit of hard scale on the condensing coils. The only water consumed is that evaporated. Unrestricted down draft air instantly removes the excess water from the condensing coils, improving the heat transfer from the refrigerant gas to the air stream. The excess water is recirculated.

All sections of the condenser are encased in separately removable panels for complete accessibility for painting or to allow the coils to be cleaned from any side. Removing a single panel gives entrance to the central plenum and puts all interior parts within reach.

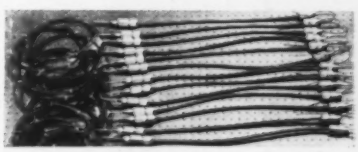
The company says much expense is saved by the design which permits shipment of the casing as flat panels rather than boxlike shapes. In many locations, either on the ground or on roofs, additional savings are possible by building a concrete spray pan on the site.

There are four sizes: 90, 120, 180 and 240 tons. The ratings are for ammonia; the condensers are also applicable to freon.

Boiler Return System

Patterson-Kelley Co., Inc., of East Stroudsburg, Pa., has designed a new packaged boiler return system that utilizes heat energy from high-pressure condensate to preheat incoming water for processing. The company says that recapturing this heat, which might otherwise be lost in steam flashing off, saves on steam and fuel costs. The packaged unit also reheats condensate, plus make-up water, to near steaming temperature and returns it to the boiler.

Comprising a condensate cooler and receiver, feedwater heater, and all controls, plus pumps, piping, and accessories, the new unit comes completely packaged, ready to be set up and piped to steam, condensate, and water lines. The condensate cooler is an integral part of the condensate receiver. The closed boiler feedwater heater is mounted atop the receiver. Accessories, including steam trap, strainers, gate, check and quick-vent valves, thermometers and pressure gage, are furnished completely assembled. Piping and power connections are all that are required before starting operation.



Flexible Tubing

Announcement has been made of new Flex-tube assemblies by Conax Corp., 7811 Sheridan Dr., Buffalo 21, N. Y.

The assemblies include neoprene covered flexible tubing which are factory assembled with end fittings having standard male or female pipe thread connections. The Underwriters' Laboratory approved tubing is galvanized steel or brass, interlock construction with an overall neoprene cover. The company says this construction gives permanent leaktight and vaporproof protection against oil, grease, water, dirt, chemicals, corrosive fumes, and other destructive agents.

The assemblies are made in several standard lengths and are available in any required length for special application.

Standard end fittings are cadmium plated of brass or steel, or stainless steel packing glands can be provided in place of end fittings. Many special adaptations of the assemblies to standard and special thermocouple glands are available completely assembled at factory.

NATIONAL ACME

SNAP-LOCK

TRADE MARK

THE ORIGINAL

SNAP ACTION
LOCKING
SWITCH

All National Acme Switches — Limit, Push Button, or Motor Starter Switches employ the same dependable, basic, SNAP-LOCK design. As illustrated above, the snap-action locking mechanism is simple, fool-proof and long-lived. Self-wiping, coin-silver contacts insure quick action make and break—with maximum wear resistance. For AC or DC service.

Electrical and mechanical sides are separated by a wall within a sturdy die-cast housing which is fully insulated, and is oil and dust resistant. Can be furnished water and oil-tight.

Limit Switches

Made in both single-pole and double-pole series, and with a wide variety of standard operating levers. Also made in push-lever type and with explosion-resistant housing.

Push Button

Made in heavy-duty, flush or surface-mounted types.

Motor Starter

Designed for 3-phase motors to 7½ HP on AC; ½ HP on DC.

FOR COMPLETE DETAILS send for Bulletin EM-51

Electrical Manufacturing Division

National Acme

THE NATIONAL ACME COMPANY

192 East 131st Street, Cleveland 8, Ohio

KEEP INFORMED — NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

Spherical Union Connection

Jerguson Gage & Valve Co., Somerville 45, Mass., announces a new spherical union connection for valves which compensates for up to 10 deg misalignment of vessel tappings in any direction from perpendicular axis and a wide variation in centers.

When used with a side connected gage, the spherical union on the tank connection side of the valve alone will permit a variation of plus $^3/_8$ in. to minus $^3/_8$ in. per valve or a total of $^3/_4$ in. increase or decrease on centers. For example, a gage having side connections of 20 in. could be installed on tank centers anywhere from $19^1/_4$ to $20^3/_4$ in. using straight valves with spherical union tank connections. The use of a spherical union will also take care of a tapped hole drilled at an angle rather than a true right angle to the mounting plane.

With a standard offset valve turned inwards, a situation exists where the visibility of a gage with side connections on minimum centers is $^1/_4$ in. greater than the tank connection centers, therefore permitting entrapped liquid which might falsify the reading. The spherical union enables the positioning of the column so the liquid will just disappear in the gage column and thus avoid any possibility of a false reading.

External Wrenching Bolts

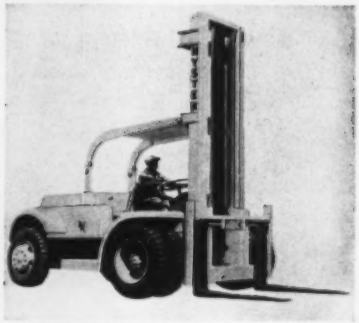
A strong steel bolt of new design has been announced by Standard Pressed Steel Co., Jenkintown, Pa. The new 12-point, external wrenching bolts, designated EWB-18 are now in production.

Tensile strength of the new aircraft type tension bolts ranges from 180,000–200,000 psi. The company says an outstanding feature of the New Bolts is the fact that they have exceptional resistance to dynamic fatigue or shock loading.

Though the bolt may be used initially in size-for-size substitution for present day bolts to beef up structural assemblies, its major advantage of saving of space and weight will result from new designs built around the fastener, the company claims. It point out that the higher tensile strength of the EWB-18 will permit reduction in the size or number of bolts needed for a given job. The savings can be considerable, since not only the weight of the bolt, itself, but also the size and weight of the connected parts can be reduced through use of the smaller, stronger fastener.

Endurance limit of the bolt ranges from 50,000–60,000 psi, as compared to 40,000 psi for the best present day, 160,000-psi steel fasteners.

The firm is producing bolts in standard diameters ranging from $^1/_4$ to $1^1/_2$ in. Bolts are made from 4340 and 8740 alloy steels and are cadmium plated by the fluoborate method. This special cadmium plating is used to further the prevention of hydrogen absorption during electroplating. Bolts will have a minimum tensile strength of 180,000 psi.



20,000-Lb Lift Truck

Availability of a compact and highly maneuverable lift truck of 20,000 lb capacity at 24-in. load centers has been announced by Hyster Co. The new unit, TC-200, is patterned after the firm's RC-SC lift truck series. The company says complete driver "feel" of the truck in all weather conditions has been created by convenient, easy to operate controls and an exceptional degree of visibility.

Maximum stability and rigidity under capacity loads is the result of an exclusive overhead tilting mechanism and new heavier-duty uprights, the company says. The unit is gasoline powered with a Hercules industrial engine. Factory installation of a Perkins P6 diesel engine is optional. The truck has a travel speed of more than 20 mph in either forward or reverse. It has vacuum-powered brakes, and center-point steering and sharp outside turning radius of 179 in.

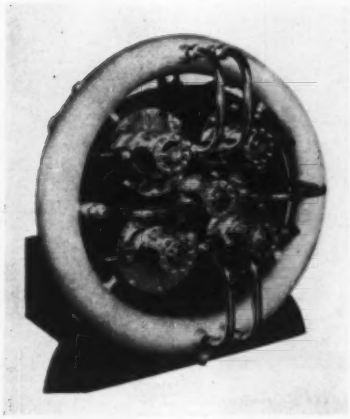
The truck is $166^1/_2$ in. long and 94 in. wide. A number of attachments are available for the unit.

Complete specifications can be obtained by writing the company, 2902 N. E. Clackamas St., Portland 8, Ore.

Powder Lubricant

Tower Oil Co., 300 W. Washington St., Chicago 6, Ill., announces a new lubricant called Molyfilm that is said to be highly efficient for break-in running, wire drawing, tools, dies, threaded parts and other difficult-to-lubricate areas. It is also claimed that Molyfilmed surfaces resist galling, seizing, abrasion, and very high pressures, as well as reduce friction.

The lubricant is concentrated molybdenum disulfide, a fine gray powder that can be used as a lubricant itself or as a type of lubrication prime coating. In the latter application, it forms the base lubrication on parts normally oiled and greased. It is applied by such contact as rubbing, tumbling, or immersing. After Molyfilm has been allowed to work into the molecular structure of the metal, oil and grease are applied before putting the part to work. The company says Molyfilm is tenacious to metal, and temperatures up to 700 F, have no effect on it. For most practical purposes, it is chemically inert.



Mutiple Pump Drive

A-1 Iron & Metal Co., 10,000 S. Alameda St., Southgate, Calif., has introduced a multiple pump drive which employs a single prime mover, such as an electric motor or a diesel engine, to operate as many as nine different pumps.

The unit shown is equipped with nine hydraulic pumps, each pumping 35 gpm at 1000 psi. In this particular unit, all nine pumps are supplied through a circular manifold and total delivery is at the rate of 315 gpm. The total output can be directed to one single operation or, if desired, the output from each pump can be piped to a different operation.

With separate intakes to each pump, the unit can handle nine different fluids through nine different pumps, each of the capacity required for nine different operations. The company says any types of pumps can be used, such as gear, rotor, vane or rotor piston pumps. Many different combinations are possible.

Pumps are driven by a patented mechanism employing chains, belts, or gears. The entire assembly is compact in overall size, making it possible to mount the unit and its power source on a truck. When driven by an internal combustion engine, access to electric power is not required.

Produces New Fiber

Celanese Corp. of America has begun commercial production of Fortisan-36, a new industrial fiber, at its Rome, Ga., plant.

The company says trial reports of potential customers in various industries have shown that the fiber has properties of great strength, low elongation and dimensional stability which indicate a potential for it in such fields as V-belts, power transmission belting, high-pressure hose, conveyor belts, truck tires, plastic laminates, fibers, paper reinforcement, oil hose and tarpaulins. Fortisan-36 is the first synthetic fiber ever to be evaluated and produced for the use of heavy industry rather than the apparel trades, the company said.

Needle Pressure Gage

A new pressure gage for determining available air pressure at point of use has been brought out by U. S. Gauge, Sellersville, Pa., a Div. of American Machine and Metals, Inc.

The 2-in. diam gage is finished in chrome and comes equipped with a BD-20 hypodermic needle and guard. It permits tapping the air hose at the tool, thus determining pressure available at the tool regardless of original pressure or number of tools on the line.

Aluminum Radioisotope

Nuclear Science and Engineering Corp., Box 10901, Pittsburgh, Pa., is offering a limited supply of the recently discovered long-lived radioisotope of aluminum, Al^{26} decays by positron emission, positive charged electrons of 1.30 Mev energy and with a half life of -10^6 years. Al^{26} is available as Al_2O_3 with a specific activity of 3×10^4 dpm (positrons)/g Al_2O_3.

Marine Loading Device

What is said to be a new concept in loading and unloading of petroleum and chemical products has been revealed by Chiksan Company, Brea, Calif. The device known as a hydraulically controlled marine loading arm, is designed to speed up tanker operations while providing an unusually high degree of safety to dock workers and equipment.

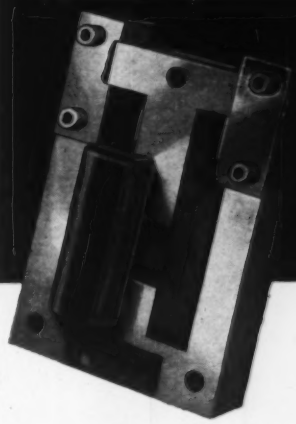
Mounted on a structural steel frame located approximately 10 ft from the water's edge, the loading arm consists basically of two lengths of aluminum pipe of 6-, 8 or 10-in. diam. These are coupled together by aluminum swivel joints. A boom and cam arrangement, powered by hydraulics, enables one man stationed at a remote control point to place the flanged end of the arm aboard the largest existing tanker in one minute. Once aboard ship, a two man crew can easily make up the flange to the deck manifold.

When attached, the power system on the arm is placed in free wheeling. This allows for a 40-ft rise and fall of the ship in the water, and permits a 20-ft drift of the vessel during loading or unloading operations. In free wheeling, operations may proceed unattended. When detached, the arm can be returned to a rest position in less than a minute.

As many as seven arms may be operated from one set of controls. When mounted in multiples on one structure, the arm to be attached is selected by means of a selector valve with selector dial located at control point. One 7.5 gpm, 500 psi vane type pump and one 3 hp motor power the movement of each of the arms in turn.

The arm is grounded for static and is spark resistant. The unit is operational at temperatures as low as −60 F and to 225 F without deterioration or lessening of ease of operation.

NATIONAL ACME
SOLENOIDS
WITH ARMORED CONTACT POINTS
For Millions Of Dependable Operations



Standard... or Custom Engineered

National Acme Solenoids will make your job easier—because they do their job better!

1. Made in Push and Pull types—within sizes ranging from 2½ to 21 lbs. at ½-inch stroke—to 2 to 25 lbs. at 1-inch stroke.
2. Rugged enough for the heaviest type of duty.
3. Compact—especially suited for limited space service.
4. Non-magnetic retainers.
5. Available with terminal blocks and variety of standard mountings.

Send for complete details in BULLETIN EM-52—or discuss your design problem with our representative.

Electrical Manufacturing Division
National Acme
The National Acme Company
192 East 131st Street, Cleveland 8, Ohio

structures

STRESS ENGINEERS · STRUCTURES ENGINEERS · WEIGHT ENGINEERS · LOADS ENGINEERS · DYNAMICS ENGINEERS · FLUTTER ENGINEERS · COMPUTER SPECIALISTS · MECHANICAL ENGINEERS · CIVIL ENGINEERS

Expansion within Northrop Aircraft's Structures Department is creating an urgent demand for qualified personnel in all phases of guided missile, piloted aircraft, and equipment development. Included among the most critical job openings are positions for:

Stress Department—Mechanical or Civil Engineers to design missile ground handling equipment. An opportunity for men without aircraft experience to take advantage of the aircraft pay scale.

Structures Research—Creative engineers for three vital phases of Structural Research and Development: Thermo-Structural Analysis, High Speed Computing Technique Development and Structural Materials Research.

Weight Engineering—Junior Weight Engineers for diversified phases of missile and aircraft projects. Excellent opportunities for advancement in a relatively small department.

Dynamics—Experienced flutter engineers required for work on a variety of dynamics problems including flutter models, analytical work involving electronic computers, and methods development.

Loads—Exciting and diversified assignments in the fields of both piloted and pilotless aircraft are now available in Structural Loads Group for engineers of all experience levels.

Stress Department—Experienced Structural Engineers for positions on Long Range Interceptor Project and on advanced missile designs.

A wide diversification of assignments within each field of specialization awaits the men capable of filling the above assignments. Responsibilities will include work on many phases of missile and aircraft design, guidance systems and boundary layer research.

If you qualify for any of these challenging opportunities, we invite you to contact Manager of Engineering Industrial Relations, Northrop Aircraft, Inc., Hawthorne, California, or call ORegon 8-9111, Extension 1893.

NORTHROP AIRCRAFT, INC.

PIONEERS IN ALL WEATHER AND PILOTLESS FLIGHT

5-A-49-B

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Motor Fastener

Four to five hundred per cent increases in production rates plus material cost savings of more than three cents per unit are claimed by the company to be possible through use of a new speed clip introduced by Tinnerman Products, Inc., Cleveland, Ohio. The clip is used to secure fractional horsepower electric motors to mounting brackets.

Adaptable to any standard electric motor rated up to $^3/_4$ hp, the new clip provides a firm attachment under the most severe vibrations and starting torques, the company says.

Assembly is simple. One end of the new fastener is merely clipped over a notch on the motor mounting bracket. The other end of the clip is then snapped down with a simple tool over a notch on the opposite side of the bracket to complete the assembly in seconds. Two clips are used per application.

The new clip replaces a pair of four-piece screw clamps and can eliminate the need for excessive handling and stocking of parts.

Calibrated Torque Source

Bulova Research and Development Laboratories, Inc., Equipment Div., 62-10 Woodside Ave., Woodside 77, N. Y., announces its new all electric calibrated torque source for testing and measuring the torque characteristics of pallet mechanisms, small gear trains, servos, springs, clutches, and similar devices.

A universal chuck on the front panel, driven by a uniquely constructed three phase motor, supplies the torque which is read directly in ounce-inches. Shaft speed is indicated on an additional meter while output jacks provide for external recording of both torque and speed.

An accurately machined table is rigidly mounted parallel to the output shaft for quick alignment of objects under test. Auxiliary mounting brackets are available to fit specific applications. Useful for laboratory or production requirements as a torque source as well as calibrated dynamometer, the unit has a range of .05 to 40 oz-in. with better than 5 per cent over-all accuracy at shaft speeds from zero to 100 rpm. Additional speed ranges are available.

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NEW EQUIPMENT
BUSINESS NOTES
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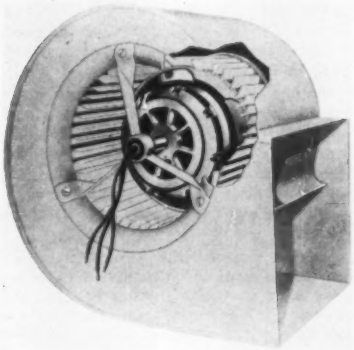


Blower Motor

Development of a new integral drive blower motor which the company says it expects to revolutionize present concepts of centrifugal blower design has been announced by the Electronics Div., Iron Fireman Mfg. Co., 2838 S. E. 9th Ave., Portland, Ore.

Specifically designed for sale to blower manufacturers and the heating-air conditioning industry, the new motor differs from conventional motors in that the rotating element or rotor is on the outside and revolves around a stationary shaft and field coil assembly. A flange on the rotor connects directly to the blower wheel, in effect making the motor an integral part of the wheel and eliminating the necessity for belts, pulleys, or special motor mounts.

All phases of motor design and application are said to be completely functional to realizing the maximum advantages inherent in centrifugal blowers. Over-all advantages are said to be greater air delivery in relation to the size, weight, power input, and cost of the blower-motor combination.

Blower wheel and motor share a common shaft to form a single integrated assembly centrally positioned within the scroll so that air flow is unrestricted at both ends of the blower. Both ends of the shaft are cradled in soft rubber to isolate noise and any possible vibration. However, the company says, vibration is practically nonexistent because the motor is so constructed that it can be dynamically balanced not only for mechanical imbalance, but also for electrical imbalance. Only 6 in. in diam (exclusive of the connecting flange) and $4\frac{1}{2}$ in. wide, the motor in no way adds to the size of the blower. In addition, the motor is specifically designed to enhance distribution of incoming air across the wheel blades, increasing blower efficiency and making possible the use of minimum size blowers for a given capacity.

Compactness of the blower-motor combination, plus the fact that it can be mounted in any position, is said to make possible greater versatility of application and smaller over-all sizes of furnaces and air conditioners.

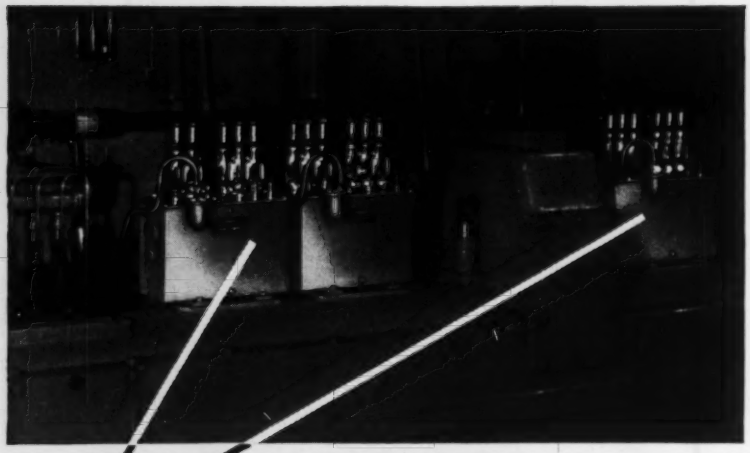
Also contributing to increased efficiency is the unique design of the motor end shields.

CAPACITIES UP TO
30,000 lbs. of steam
PER HOUR
Wrapped up and Ready to Go!

Titusville Type WTP WATER TUBE
Steam Generators

This famous power package is shop-assembled, shipped complete with all components installed, and occupies a minimum of space in the plant. You couldn't ask for a more efficient, dependable and simple-to-operate unit—as you'll agree when we give you the details! Let us have your requirements, without obligation.

TITUSVILLE
A division of Struthers Wells
THE TITUSVILLE IRON WORKS COMPANY
TITUSVILLE, PA.
Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement



MANZEL

FORCE FEED LUBRICATORS Control Lubrication to Save Oil and Cut Production Losses

Outdated lubrication practices can waste half, or more, of all the lubricants you buy. Only the exact amounts needed — never more and never less — are used with Manzel Force Feed Lubricators. There's no waste!

And because Manzel Lubricators operate dependably and automatically without thought or attention, they save labor and the cost of unexpected breakdowns caused by faulty or neglected lubrication. They quickly pay for themselves and then keep on saving money through the years.

Can be built into new, or installed on existing equipment. On any question of how best to lubricate, always call or write Manzel.

SPECIAL QUALITY FEATURES OF MANZEL LUBRICATORS

- Completely protected with Parco Lubrite
- Rust resistant reservoirs
- Closer fitting plungers made possible by special precision equipment
- Gears of harder alloy for longer wear
- Every unit factory-tested before shipment

FOR CHEMICAL FEEDERS, TOO, CONSULT MANZEL

Professionally qualified engineering representatives throughout the country.

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DIVISION OF
HOUDAILLE INDUSTRIES, INC.
353 BABCOCK ST., BUFFALO 10, N. Y.

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Air for cooling the motor enters both ends of the motor near the shaft and is expelled through slots in the outer rim of each end shield in harmony with the natural action of the blower. As a result, the cooling air does not pass through the precision air gap or other restricted passages and the danger of dust, dirt, and lint interfering with the operation of the motor is thus eliminated. An automatic resetting overload protector guards against mechanical and electrical overloads.

A service feature is the use of special quiet type ball bearings which are said to never require oiling. Since the motor bearings are also the wheel bearings, there is no need for periodic servicing of the unit, the company says.

The motor itself is a permanent split capacitor type. Speed automatically changes with variations in static pressure, a feature which, the company says, tends to compensate for the effects of dirty filters and other variables encountered in furnace and air conditioner applications. First production models are rated at $\frac{1}{4}$ hp, and are designed to operate 9-in. blowers and some 10-in. blowers on 115 v., 60 cycle current. Other ratings are to be available in the coming months. Emphasis throughout is on extreme simplicity of design. There are no switches, starting relays, or centrifugal devices. The motor weighs but $12\frac{1}{2}$ lb. The design, plus mass production with precision machinery, will enable the motor to be sold at a price competitive with conventional motors of the same ratings, according to company spokesmen.

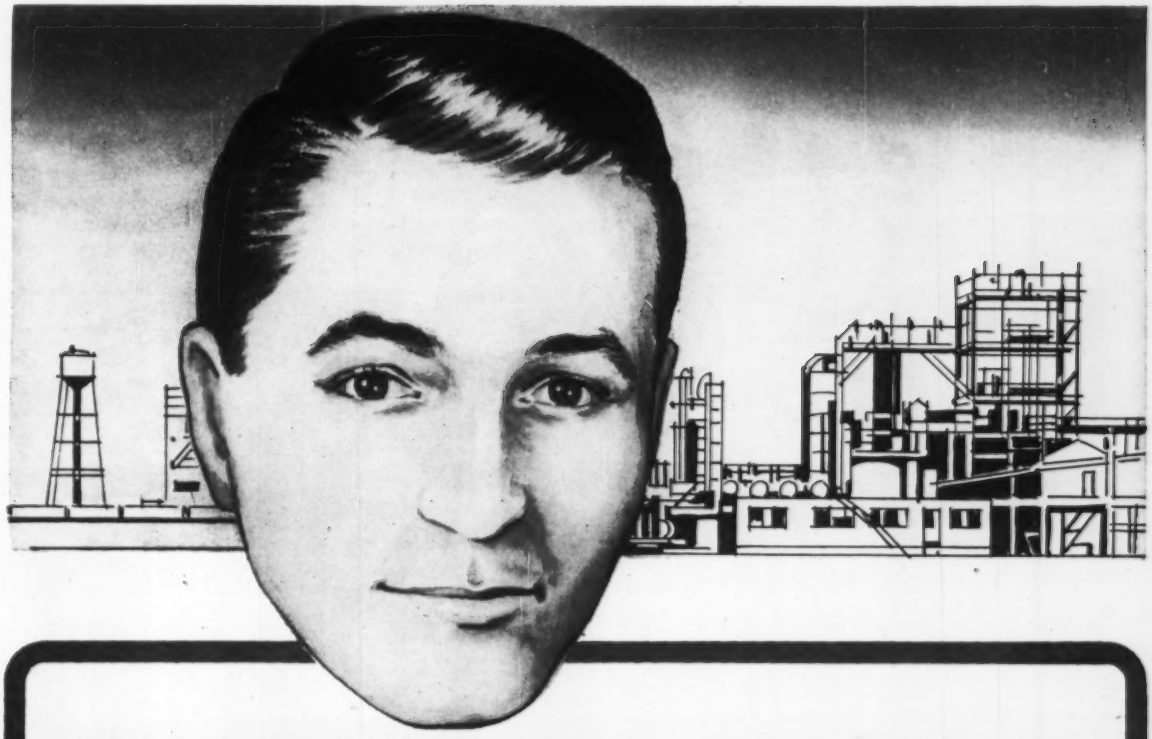
Counting Instruments

New "magnetic" industrial counting and control instruments operating at electronic speed and precision, yet said to offer the ruggedness and continuous-duty reliability of simple electromagnetic devices, are now in production by Berkeley Div., Beckman Instruments, Inc., 2200 Wright Ave., Richmond 3, Calif.

Heart of the new instruments is a miniature wirewound magnetic amplifier, epoxy resin-encapsulated in a tiny plastic cube measuring $\frac{9}{16}$ in. on all sides. Trademarked the "Ferristor," this rugged electromagnetic component performs most former vacuum tube functions, the company says. Ferristors are nonaging, immune to damage caused by shock, vibration, moisture or prolonged overloading. They produce little or no heat, permitting dusttight enclosures on the new magnetic instruments.

First of the new magnetic instruments is a dual preset controller capable of counting at rates to 10,000 counts per sec, and producing output signals at each of two presettable count totals. Accuracy is absolute. Input count pulses may be obtained from photocells, magnetic pickups, electrical contacts. Output signal through built-in relay, rated at 5 amps, operates solenoids, power relays or other control devices. First signal

Continued on Page 50



ENGINEERS

Join a Dynamic Company Now Entering Its *4th major expansion in its 4th year!*

Rewarding challenges await alert engineers in this dynamic, rapidly-expanding new industrial frontier. These challenging advantages are now yours for the asking with an equally dynamic, expanding Company now in its *fourth major expansion of its fourth year!*

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TOMORROW'S BIG DECISIONS WILL BE MADE **by the men who act today...**

The most advanced developments in electronics are being made in the sphere of airborne radar and related ground control systems because of military emphasis.

Further applications of electromechanical techniques in these fields are creating new openings in the Systems Division of Hughes Research and Development Laboratories.

Engineers who have demonstrated ingenuity and inventive ability will find interest in areas of work that call for devising reliable, maintainable, manufacturable designs for precision equipment developed at Hughes Research and Development Laboratories.

The design of this equipment, manufactured at Hughes, involves mechanical, electromechanical, electronic, microwave and computing problems. Design also requires the use of such advanced techniques as subminiaturization, unitized "plug-in" construction, with emphasis on design for volume production. Knowledge of electronic components, materials, finishes and military specifications is useful.

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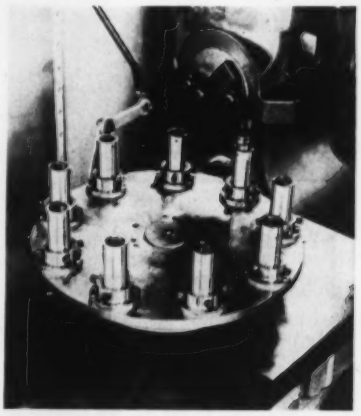
KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

may be used to slow down operations preparatory to stopping at second, or final, preset count total.

The company says industrial applications of the units include precise control of batching, weighing, counting, sorting and packaging equipment; cutting sheet or strip stock to length; machine or process control, sequencing.



Rotary Feed Table

Bal-Aero Products Co., 4439 Santa Fe Ave., Los Angeles 58, Calif., has introduced new rugged, lightweight, rotary feed table.

The table, all steel, either mechanically or air-operated, is at least five times faster than average due to simple design and accurate indexing, the company claims. The index gear, made of meehanite casting, wears in, not out, saving considerable time and money for greater production, the firm states.

Outside diameter of the standard size table is 15 in. and can be supplied in any diameter from 12 to 36 in. Overall height, less dial plate, is $1^3/_4$ in. with standard index of 12 to 24 stations. The index gear diameter is $6^1/_2$ in. by $1^3/_4$ in. thick. All pivot points are double seal bearings and oilite bushings.

Quick Connect Fitting

A new Swagelok quick connect fitting, manufactured by Crawford Fitting Co., Cleveland 10, Ohio, is designed so that it can be connected and disconnected with the thumb and finger.

The shutoff valve incorporated in the fitting acts as a positive seal to prevent any leakage during the connecting or disconnecting operation, the company says. Internal design is said to allow freer flow than is possible with fittings of similar type: The new fittings are slim and streamlined for convenience in handling.

Used with plastic tubing and metal tubing, the fittings are available in all metals, in sizes to fit ordinary applications and in 3 types: tube to tube with Swagelok ends; tube to pipe with one Swagelok end; bulkhead, either tube to tube or tube to pipe.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Explosion-Proof Aircraft Motor

An explosion-proof, aircraft electric motor suitable for pump or compressor drives, has been placed in production by U. S. Electrical Motors Inc., Box 2058, Terminal Annex, Los Angeles 54, Calif. Designated Type SEV-GA, the motor has undergone extensive explosion-proof tests in compliance with military specifications. Designed for continuous duty, the motor operates on 3-phase, 400-cycle, 200-v ac, and delivers 1.5 hp at 1500 rpm.

The motor weighs only 17 lb. Rigid pyramidal design of base supports the motor and application with equal weight distribution on both sides. The maximum operating altitude of the motor is 6000 ft. A sparkproof fan blows air over ribs to cool the motor.

Plastic Coating Process

Announcement of a new process for providing corrosion-resistant coatings of polyethylenes, polyfluorocarbons, nylon, and other plastics on metallic and dissimilar plastic molded targets, has been made by the American Agile Corp., Maple Heights (Cleveland), Ohio.

Until this time, certain targets could be coated with polyethylene, to provide corrosion resistant surfaces, by using special spraying equipment. However, many additional targets could not be sprayed because of their small size and/or irregular shapes.

The new process, known as the fluidized coating process, will be displayed for the first time at the 25th National Chemical Show in Philadelphia.

According to the company, the fluidized coating process, a brand new concept in coating techniques, fills the last major gap in the anticorrosion coating field. It will enable industry to apply on-the-spot corrosion protection when and where it is needed, at an exceptionally low cost, and in 50 per cent less time than was required with spraying.

The process involves the use of a powder fluidizer, a compact unit consisting of a specially designed gas distribution system which maintains the plastic powder in a turbulent dense fluid state. The appearance of the fluidized bed closely resembles that of a boiling liquid.

Also available is a line of specially blended polyethylene coating powders which can also be used with a spraying unit where this process may be utilized. The fluidized coating process provides a uniform coating up to 3/16 in. thick. The target to be coated is first preheated to predetermined temperature, then immersed in the fluidized coating powder for from 10 to 15 sec. It is then replaced in the oven, and allowed to cure for a short period.

The process, at this particular time, will be available for use only in laboratories for coating such items as stirrers, valves, containers, racks, and handling tools, which can be given a firmly-adherent corrosion-proof cladding of resin in a matter of a few minutes.

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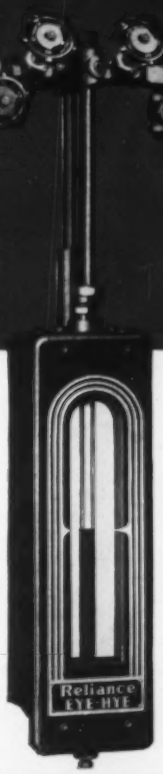

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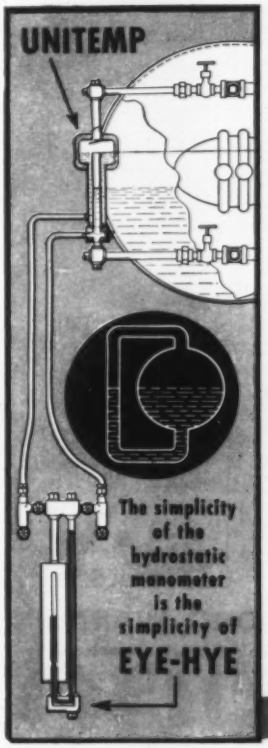

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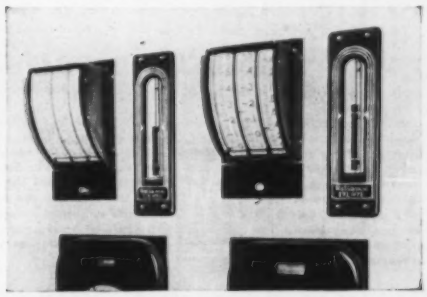

Reliance®
BOILER SAFETY DEVICES

Commercial Burners

Four new commercial gas and gas-oil burners have been announced by Iron Fireman Mfg. Co., 3170 W. 106 St., Cleveland, Ohio.

The gas burners are available in capacities ranging from 500,000 to 3,000,000 Btu input. Combination gas-oil burners fire at rates of from 5 to 20 gal of oil per hr. Gas burners are designed to fire with natural gas only.

The units, fully assembled, wired, and tested at the factory, are delivered as complete packages. They are supplied with all necessary controls, including an electronic combustion control system.

Air for combustion is furnished by an integral fan when either gas or oil is fired. No secondary air dampers are required. The company says the combination gas-oil burners are especially adaptable to installations where gas utilities require standby oil heating equipment. Quick changeover from one fuel to another is made by the flip of a fuel selector switch.

Motors are fully sealed against dust and dirt and lubricated for life at the factory. They carry the company's standard five year motor guarantee. All four burners bear the approval of Underwriters' Laboratories, Inc. Specification sheets and complete information about the new burners are available from the company.

ROCKFORD

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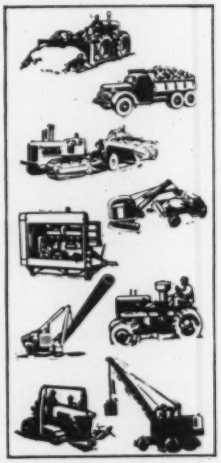

These NEW type ROCKFORD clutches have been developed and field tested by Rockford Engineers for heavy-duty clutch service. Because of their specialized characteristics, MORLIFE type ROCKFORD clutches are best suited for use in off-the-road machines such as tractors, trucks, tanks, cranes, shovels, bulldozers, earth movers, pipe layers, power units and other heavy duty equipment. For information how this NEW development will improve the operation and increase the on-the-job hours of your heavy-duty machines, write Department E.

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ROCKFORD Clutch Division BORG-WARNER
1307 Eighteenth Avenue, Rockford, Illinois, U.S.A.

CLUTCHES

Automatic Rod Bender

A new, versatile, automatic bending machine that produces up to two bends in each end of steel rods at rates up to 960 rods per hour is announced by Expert Automation Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.

The machine has a mechanically operated rotary index drum that indexes rods from a feed chute to two bending stations. Inner and outer bends are produced in each rod end by bending dies powered by single-rotation, hydraulic rotary actuators. Finish-bent rods are carried out of the machine by a roller chain conveyor.

The rotary actuators are adjustably mounted, enabling a wide variety of bend angles to be produced in each bend, as well as assorted plane relationships between the two bends in each rod end. Width of the index drum and machine size depend on the diameter and length of rod stock to be bent.

Rods to be bent are placed in a feed chute where they slide by gravity to a position ahead of the drum index. They are picked up one at a time and clamped by spring-loaded toggle clamps on the periphery of the drum. These toggle clamps, which are opened by cams at the drum loading station, grip the rods firmly near each end throughout the index and bending operations.

A motor-driven cam index mechanism transfers the rod to the first bending station where the outer bends are produced on each end by the rotary actuator-powered dies. Then the rods are indexed to the second bending station where the inner bends are similarly produced on each end, completing the bending operations. The bent rod is then indexed to the third station where it is stripped from the drum and deposited on a roller chain conveyor.

Each of the four rotary actuators that power the bending dies are slide-mounted and moved in and out of bending position by a hydraulic cylinder. The actuator and slide assemblies are cradle-mounted to provide adjustable bend angles and plane relationships.

The machine bends $^3/_8$-in. diam, 5-ft long heat-treated spring steel rods to form automotive trunk lid torsion bars at a rate of 960 rods per hour. Two bends of approximately 90 deg are formed on each end of the rod. One bend has a leg only $^3/_4$ in. long.

Cruise Control Aid

A flight angle computing system with no moving parts or vacuum tubes has been announced by the Airborne Systems Div., G. M. Giannini & Co., Inc., 918 E. Green St., Pasadena 1, Calif.

The new system is a member of the B8-1 series of differential pressure flight angle computers which use the firm's differential pressure pickup probe for sensing attack angles. Pressure data from the probe actuates standard pressure transducers, the outputs of which are combined in a passive network computer to provide pilot indication of angle of attack.

The system accuracy is as high as ±0.1 deg over a range of ±20 deg at speeds up to Mach 2.0. It was designed as a cruise control aid for optimum fuel economy in military and commercial aircraft. By the addition of a second computer, it is possible to provide indication of angle of yaw with the same degree of accuracy.

Sintered Filter

A sintered filter of unique design and versatility has been introduced by Purolator Products, Inc., Rahway, N. J. Capable of handling fluids ranging up to 1000 F, the new filter can take flow rates comparable to any high temperature filter in existence with lower differential pressures and a better degree of filtration, according to the company's engineers.

Made of sintered metal, the new filter can remove particles as small as one micron in size from a wide range of fluids, including such materials as nitric acid, hydrochloric acid, sulphuric acid, phosphoric acid and strong alkalies, the company says.

The one-piece sintered element can be made in a variety of diameters and lengths and its radial fin construction can be supplied in specified depths and numbers of convolutions to give extended area within a confined space. Varying flow rates are also available. Filters of stainless steel, monel and other metals can be made as required.

Other features of the new filter are controlled permeability and uniform porosity which can be varied as to pore size desired. Its makers say that it has a higher degree of porosity per square inch than is available in any other high temperature, metallic filter element. It can handle differential pressures of up to 500 psi.

Either internal or external threaded connections can be provided by the manufacturer. Threads are used as seals to overcome the necessity of using packings which may cause difficulties at temperatures in excess of 400 F. For very high temperature applications, the connections and elements are made into a single unit.

The development of the new filter was accomplished with the cooperation of Horizons Inc., Princeton, N. J., metallurgical research laboratories. The company says it expects the filter to find wide application in the atomic, guided missile, aircraft, chemical, petroleum, industrial and food fields.

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KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Power Cylinder Features

Several new cylinder features designed to provide longer cylinder life, improved performance and wider usage have been adopted as standard specifications by Miller Fluid Power Co., 2040 N. Hawthorne Ave., Melrose Park, Ill., and are now available at no extra cost on the firm's complete line of air and hydraulic cylinders.

The new features are: case-hardened, chrome plated piston rods; Teflon rod wipers; Teflon hydraulic rod seals; high quality black ferric oxide surfaces.

The case-hardened rods are now standard on air and hydraulic cylinders and are said to be practically immune to damage from accidental hammer blows, dropped tools, mishandling. The hard chrome plating over the rod protects against scratch damage and rust.

The rod wipers and seals are said to withstand temperatures from −100 F to +500 F, and to be impervious to practically all known chemicals including the fire-resistant, special and standard hydraulic fluids in current use.

Black oxide finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation. This finish is now standard on the cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods of all Miller air and hydraulic cylinders.

Flexible Valve

A completely-sealed, metal-enclosed flexible valve capable of operating under pressures as high as 250 psi has been developed by the Farris Flexible Valve Corp., Palisades Park, N. J. The new valve design, called "Superseal," possesses all the advantages of the firm's regular valve while broadening the fields of operation. Greater measures of safety in operation are assured by an exclusive method of sealing all movable parts as well as the valve body, the company claims.

The new valve incorporates a self-aligning drive to pinch off the sleeve body for positive tightness. Light hand wheel torque provides manual operation. It can be fitted with a diaphragm motor for instrument-operated automatic control in throttling, on-off, or remote control applications. A suitable connection provided for pressurizing the space between the flexible body and the cast housing makes possible equalization of pressure. Various sources of pressure can be used, such as an accumulator, an inlet tap or, more commonly, plant air supply.

Automatically operated valves are made in two types. Standard diaphragm motor designs supply available power for most applications. Extra-power types have diaphragm areas twice those of the standard models.

The valve is built with an inner valve sleeve available in a choice of rubber and synthetic materials. Available accessories include positioners, indicator stops, and specially designed indicators for both manual and motor-operated types.

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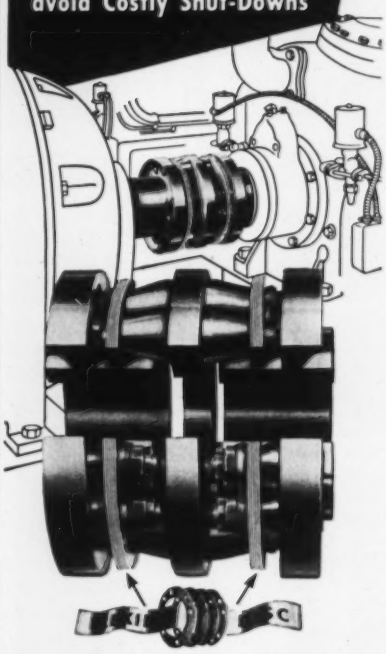

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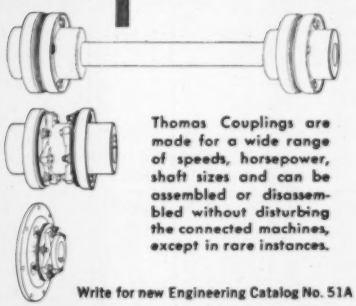

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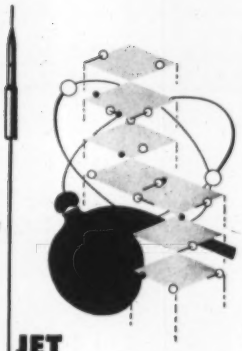

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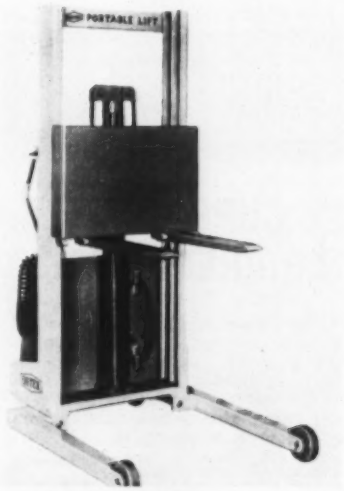
Photocopy Paper

A new improved paper for the company's Verifax copier which almost doubles copies available from a single matrix and which cuts the cost to $2\frac{1}{2}$¢ per copy has been announced by the Eastman Kodak Co., Rochester 4, N. Y., manufacturers of the photocopy machine.

The new product makes it possible to produce a minimum of five copies per matrix as compared to the three recommended for the paper previously available. In actual practice, the company points out, a proficient operator can generally exceed the minimum figure by several copies. Reports from business, industrial and education users of the copier, the company says, have shown that many operators have regularly exceeded three copies from the earlier paper. Price of the new copy paper per five hundred sheets is $3.95 in letter size and $4.95 in legal size.



2000-Lb Portable Lift

A 2000-lb capacity, multipurpose, manually propelled, hand- or battery-powered hydraulic lift, has been introduced by Oster Mfg. Co., E. 289th St., Wickliffe, Ohio. The carrier is designed for handling and stacking heavy, hard-to-manage loads with one operator.

The unit is designed to provide four carriers in one: a platform truck, a straddle fork truck, a portable elevator, and a shop crane. Exclusive features including adjustable legs which allow the carrier's legs to ride straddling the load or beneath the load as required, new design adjustable forks, and remote control as standard equipment at no additional cost on power operated models.

The carrier features a built-in charger on battery powered models; platforms that lower flush with the floor; substantial overload capacity; and a flow control valve to control the speed of descending loads and prevent a "free fall."

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R/M Fabric Piston Cups are thoroughly inspected, hardness is consistent, and they adhere strictly to industry standard sizes. To meet your requirements, R/M engineers will recommend the proper combination of asbestos or other strength member with rubber-like synthetic composition to best meet temperature and pressure conditions.

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PACKING DIVISION, PASSAIC, N.J.

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RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Laundry Pads and Covers • Bowling Balls

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Torque Measurement

A small, low cost and simply operated precision instrument which incorporates a new technique for measuring torque on ball bearings has been developed by Control Instrument Co., Brooklyn, N. Y., subsidiary of Burroughs Corp., 219 Fourth Ave., New York 3, N. Y. Called the mass accelerator, the new device is designed both for laboratory and factory use.

The 24 lb instrument, whose dimensions are $8 \times 10^1/_2 \times 8^1/_2$ in., tests bearing torque in the following way: A known inertia load is mounted on the outer race of the bearing. The inner race is rotated at a known rpm. This is done in such a way that bearing friction torque is the only force which causes the outer race to move. Torque is determined, according to graph or empirical formula, by the number of inner race revolutions required to make the outer race carry out one revolution.

A synchronous "instant starting" motor with the necessary circuitry to effect instant stops is used.

The mass accelerator meets all known laboratory requirements for range, sensitivity, accuracy, and speed of testing, according to the manufacturer. It is ruggedly constructed, needs no precise power supply, special vibration mounts or specialized operator skill. It can be operated on any work bench or table, and can handle all instrument bearings from .1875 to 1.500 in. OD. A unique characteristic is its capacity to provide constant readings from repeated tests of the same good bearing.

The instrument is capable of accurate operation through a temperature range of −85 to +140 F. With these features, the mass accelerator can also be used as a temperature-viscosity lubrication tester, the company says.

Induction Heaters

A new line of electronic type induction heaters, featuring a total of 16 models in four output ratings for brazing, soldering, surface hardening, and annealing, has been introduced by General Electric Company's Industrial Heating Dept., Schenectady 5, N. Y.

The new line consists of induction heaters which have been rated: $7^1/_2$, 15, 25, and 40-

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
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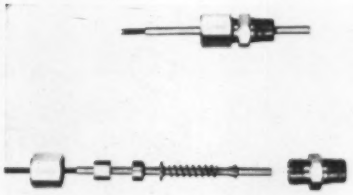
kw output. Each heater model is offered with combinations of thyratron power control, built-in output transformer, or tapped tank coil. Additional features include dust-proof cabinets, separate aluminum enclosures for oscillator units. Also, longer tube life can be realized since filament voltage is regulated with constant-voltage transformer, according to G-E. In addition, the company says, maintenance is simplified by the unit's welded-steel cabinet with ample space provided for access to components.

Voltage regulation of oscillator and rectifier tube filaments maintain voltage within plus or minus three per cent of rated value when the induction heaters are operated at specified line voltage. Panel control instruments for the new units include plate-current ammeter, grid-current ammeter, filament voltmeter, and tube filament hour meter.

Protective devices provided include overload relay in high voltage d-c plate supply, fused control circuit, time-delay relay for tube warm-up, water flow interlock switch, over-temperature interlock switch, and interlocked access doors which help protect the operator from high voltage.

Designed and certified to comply with FCC regulation, the new heaters' oscillator tube and tank circuit is water cooled, while terminals of the oscillator tube and base of rectifier tube are cooled by blowers.



Thermocouples

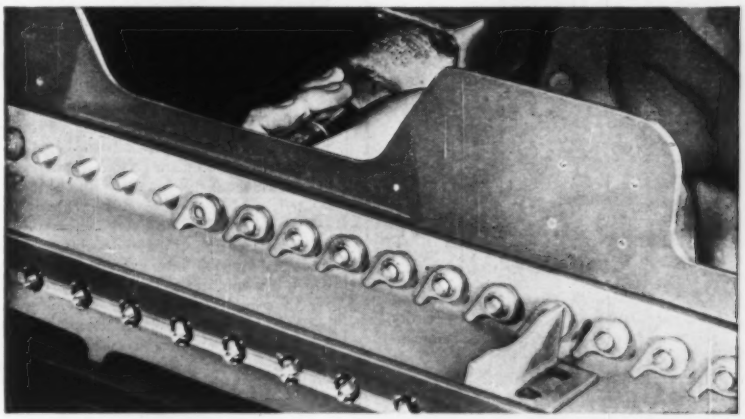
Announcement has just been made of a new, pressure sealing spring loaded thermocouples by the Conax Corp., Buffalo 21, N. Y.

These compact, self-contained thermocouples insure positive contact for high thermal conductivity, the company says. They are used for checking bearing temperatures, surface temperatures, injection molding machine temperatures and other similar applications.

Fast response is insured by the small, 1/8-in. diameter, two wire pyod construction. The sealing method eliminates entry of foreign matter into the system as well as sealing internal vacuum or pressure to 200 psi. Fittings and tubes are made of Type 303 stainless steel. Tubes are available in lengths to meet particular application requirements.

The thermocouples are available with either Iron-Constantan or Copper-Constantan calibrations. Standard pipe thread connection is 1/8 in. ips.

FASTENER PROBLEM

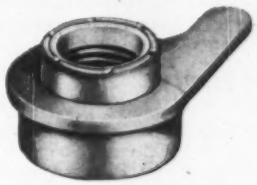


Tightening wing joints without disassembly

Because an entire section of the wing on the F-100 Super Sabre produced by North American Aviation is designed to serve as a fuel tank, fastening the milled skin to main structural members presented several problems. Normal fastener choices would have been either hex nuts or, for blind areas, anchor nuts angled close together and riveted to the beam. Since the entire section had to be sealed to prevent fuel leakage, these rivets would add new sealing complications. Moreover, dozens of rivet holes drilled into a main beam would mean that a stronger and therefore heavier member would be necessary.

Still another problem was presented by the nonfuel carrying sections of the wing and particularly the main attach joint for the leading edge, because field service requirements can make it necessary to re-tighten bolts. This would be impossible with ordinary hex nuts because the joints are inaccessible for wrenching—unless the entire leading edge section is removed.

On the F-100 these problems are solved by using ESNA's self-wrenching nut, pictured below. It has a self-wrenching lug, located high on the nut body to clear the fillet radius of the adjoining flange or structure, which prevents the nut from rotating during wrenching of the bolt. Shown installed along the wing's leading edge (above), ESNA's self-wrenching nut makes retorquing a matter of minutes, instead of hours. Additional sealing operations and riveting of anchor nuts to major structural members are avoided—while original assembly is faster and easier.



Axial tensile strength is equivalent to 160,000 psi at the minimum pitch diameter of the bolt thread. A complete line of these fasteners is available in sizes -048 through -098.

MAIL COUPON FOR DESIGN INFORMATION

ESNA

Dept. N86-111, Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastener information:

☐ Details on ESNA self-wrenching nut

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name_____ Title_____

Firm_____

Street_____

City_____ Zone_____ State_____

YOU GET WHAT YOU PAY FOR

VICE-PRESIDENT, THE CINCINNATI GEAR CO.

John Ruskin knew what he was talking about when he wrote: "There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper, and the people who consider price only are his prey." Just as this applies to ice cream or magnetos or wool socks, so does it apply to gears.

This "cheap price" paid for a necessarily cheap product may not prove to be such a bargain if the ultimate cost of using such a product can be determined. In the case of gears, each of the following points directly affects *final* cost: 1. The "price tag" on the gear itself. 2. Extra assembly time wasted in fitting and salvaging "off color" gears. 3. Lack of reasonable service life. 4. Excessive noise. The first point is obvious, and the second becomes so upon observation: for not until the gears have been assembled, "run off," and passed by inspection can the direct cost of the gears be determined. Often part or all of the potential savings on "price" are lost (often without even being recognized) on the assembly floor. Points three and four represent more insidious and hard-to-measure costs—but costs that can be even more damaging, for they will be measured by your *customer*, and can easily spell the difference between repeat orders or a customer lost for good.

Thus the *ultimate cost* of a gear that appears to be a bargain may, in the final analysis, actually be exhorbitant. That's why it can *pay* you to buy *good* gears, custom made for your specific application—gears made by The Cincinnati Gear Company.

THE CINCINNATI GEAR CO.

CINCINNATI 27, OHIO

"Gears—Good Gears Only"

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NEW EQUIPMENT
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Mechanical Presses

Hamilton Press Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio, announces a line of mechanical presses which includes welded steel top drive full eccentric type presses from 400 to 4000 tons capacity. The machines feature a new development, the company's double lube system of lubrication which incorporates pressure and through the use of troughs and gravity flow, keeps all bearings lubricated even if the pressure and flow switches used in a standard pressure lubrication system should fail. All bearings are doubly lubricated by both pressure and gravity lubrication.

Each unit has an air clutch which embodies the unusual feature of being both a low inertia type and yet is mechanically interlocked. It does not depend on the timing of valves and switches to prevent overlap. The low inertia design allows for clutching and declutching at speeds almost equal to the continuous speed of the press, the company says. This clutch also can be inched at low torque when setting dies. If the slide should become stuck on bottom center when setting dies, it is stuck with low torque and may easily be unstuck.

Pneumatic Switching Valve

A new pneumatically operated switching valve for use with dual pressure pneumatic control systems has been announced by Johnson Service Co., Milwaukee 1, Wis.

Called the V-132 switching valve, this exhausting three-way valve, the company claims, will switch automatically on a dual supply pressure change, eliminating the need for a separate air line from a central station to accomplish the switching. Use of the valve for unit ventilator control is said to reduce installation time and eliminate the need for a second pressure-electric switch and a solenoid air valve. The three pipe connections are normally open, closed, and common.

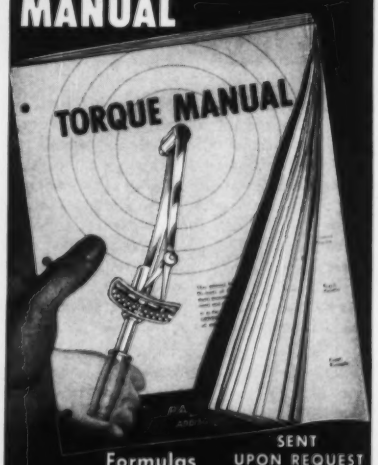
Power Supply

A new multi-purpose power supply designed to power all types of laboratory, field and factory electronic test setups has been developed by Hewlett-Packard Co., Palo Alto, Calif.

The instrument is Model 711A, offering a voltage range of 0 to 500 v and no-load to full-load regulation of better than ±0.25 per cent or 0.5 v. Ripple is less than 1 mv. There are separate current and voltage meters, with new push-button range switching for accurate measurement of very small voltages and currents. Additional features include complete overload protection and grounding of either positive or negative d-c terminals.

The instrument weighs 18 lb and is enclosed in an all-metal case with carrying strap. The manufacturer states the instrument is unusually convenient to operate and particularly versatile for its type. Model 711A is priced at $225.

"TORQUE WRENCH" MANUAL



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Formulas
Applications
Engineering Data
Screw Torque Data
Adapter Problems
General Principles

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ADDISON QUALITY ILLINOIS

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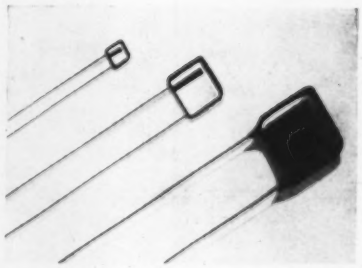

Wafer Thermistors

A complete series of wafer-type thermistors, designed for temperature compensation of transistors and other temperature dependent devices, is now available from the Thermistor Corp. of America, Metuchen, N.J.

The new elements are stocked in a complete range of resistance from ohms to megohms, and are available with extremely high temperature coefficients (up to 7% per °C. at room temperature in high resistance values). When furnished with stranded leads, these thermistor wafers—even in sizes as small as $1/10$ in. square—possess the same power handling ability as older types up to $1/2$ in. in diameter.

A patented manufacturing process allows TCA to make sample wafer thermistors of any resistance value immediately available for initial design and development studies. A special waxed-phenolic coating, provided for insulation and moisture-proofing, is optional.

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Pressure Transducer

A new pressure transducer of the magnetic reluctance type, Model P-1, is offered in ranges from 1/4 psi to 100 psi gage or differential by Pace Engineering Co., 6914 Beck Ave., North Hollywood, Calif. In differential pressure service the nominal maximum line pressure rating is 500 psi. The transducer has an accuracy rating of ±1 per cent full scale, and may be operated in recording and control systems compatible with inductance ratio input devices.

The pressure sensing element is a diaphragm, magnetically coupled to a pick-off system embedded in the body, resulting, the company says, in extreme mechanical rigidity and ability to measure the high frequency components of pressure transients. The high electrical output characteristic is typical of magnetic reluctance transducers and may be realized over a broad range of excitation frequencies.

Features include 416 stainless construction, low pressure chamber volume, and positive overload protection in both directions. The Model P-1 weighs 13 oz, and is 1 3/4 in. in diam and 2 1/2 in. in overall length.

Pipe Strainers

Armstrong Machine Works, Three Rivers, Mich., announces development of 6 sizes of carbon moly steel strainers in addition to its present line of cast semi-steel strainers.

The new Y-type pipe strainers for oil, gas, air, water and steam lines are suitable for pressures to 900 lb and temperatures to 900 F. Maximum pressure at 100 F is 1800 psig.

Expansion Joints

Allen-Sherman-Hoff Co., 259 E. Lancaster Ave., Wynnewood, Pa., introduces a new line of expansion joints for pneumatic materials handling systems. These A-S-H joints provide unusually long-wearing, air tight connections for long pipelines.

A-S-H joints are made for 4, 5, 6, and 8 in. ID Ashcolite pipe and classes C and D cast iron pipe. These new units accommodate axial expansions up to 1 1/2 in. per joint. The peripheral fitting of expansion joint sleeves over pipe ends minimizes wear by removing the entire assembly from the flow of materials. An air tight seal is assured by two inner-sleeve piston rings riding on the accurately machined outer sleeve.

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American No. 13 Series CRUSHERS

Designed for capacities beyond those of lab mills and below those required for large-scale crushing operations. Effectively used for wide range of materials. Up-Running Models (for maximum fines); Down-Running (for minimum fines). Equipped with rings or any of a full variety of hammers. Backed by over 40 years' experience in building reduction equipment. Write for Catalog on "13" Series Crushers.

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Send material sample for test reduction and recommendations for reduction equipment.
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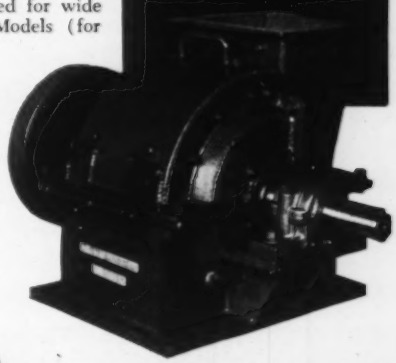

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You must be able to originate new systems concepts as applied to weapon control systems. Experience must include integration or coordination of weapons systems or large radar systems. BSME necessary, plus 10 years' experience in mechanical design of military electronic equipment.

2 MECHANICAL DESIGN CONSULTANT

You will direct the mechanical design of weapons systems and radar, to attain low cost, design simplicity and high productivity. BSME necessary, plus 15 years' electronic experience in fabrication, assembly finishing, cost analysis and design of military electronic equipment. Supervisory and processing experience in light metal fabrication desirable.

In these high level positions, there's excellent opportunity to advance with RCA's engineering staff in the complex, challenging guided missile field. You will work in RCA's new, completely equipped engineering laboratories in Moorestown, N.J. You and your family will enjoy living in nearby suburban communities, with fine schools.

Please send resume of education and experience to:

Mr. John R. Weld, Employment Manager
Dept. B-6A, Radio Corporation of America
Camden 2, N. J.

RCA

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ENGINEERING PRODUCTS DIVISION

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ARMAMENT INSTALLATION
AERODYNAMICS
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Recent Graduates with Aeronautical, Mechanical, Civil or Engineering Physics Degrees may qualify.

Proof of U. S. Citizenship required
APPLY IN PERSON
OR SEND RÉSUMÉ TO
Engineering Personnel Dept.
INTERVIEWS AT
Employment Office
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GRUMMAN AIRCRAFT
Engineering Corp.
Bethpage, N. Y.

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Rotary Pressure Joint

An improved rotary joint is now being produced by Seamlex Co. Inc., 41-23 24th St., Long Island City 1, N. Y. It is of 1¼-in. pipe size, single-flow type PR 25, designed to convey liquids or gases from a stationary pipe outlet to a revolving cylinder, drum, calender, dry can.

All of the features of the firm's earlier model rotaries, such as exterior screw adjustment, floating rotary seal, and pressure equalizing chamber, are found in this larger rotary joint, in addition to a number of improved features.

The new unit is equipped with two ball bearings to support and guide axially, the revolving shaft, thus preventing misalignment and wobbling of the shaft. This feature assures continuous leakproof performance, the company claims.

Elevator-Conveyor

Introduction of a permanent magnetic elevator-conveyor for automated handling of items such as bottle-caps, cans, nails, bolts, blanks, finished parts, scrap, etc., designed to operate with easy efficiency even under space limitations heretofore considered unacceptable to equipment of this type, is announced by Eriez Mfg. Co.

Called the Eriez Magna-Mover, the magnetic conveyor is notable for several features new to this branch of magnetic automation. For example, the extended transition section which permits easy discharge into carts, pallets, bins, etc., or into other machinery in a line, has a bed which is gently curved on a radius of 15 in. to allow handling of relatively large objects with high centers-of-gravity. The fork-like legs of the base, only 1½ in. high at their highest point, will fit under low pallets, skids, machines, etc., conserving floor space and providing for close-up operation wherever desired. The inclined magnetic bed of the Magna-Mover is readily adjustable to any pitch from 60 to 90 degrees relative to the floor line.

The automation values of this new Magna-Mover are many: production costs are lowered by reduction of manual handling; production is increased by cutting down loading and unloading and handling delays; quality is increased because parts are not damaged by piling up and hitting each other; shortens lengths of conveyor lines; provides safer operation by eliminating hazardous handling of sharp or jagged objects; reduces manpower fatigue.

The unit is equipped with two 4-in. diameter wheels scientifically placed to facilitate easy maneuvering down aisles, around corners and between machines. For extreme mobility, caster attachments for the fork ends are available. Motor and drive are enclosed in a steel housing to prevent damage from contact with other machinery.

Maintenance is reduced to a minimum in the new Eriez unit, which is equipped with permanently lubricated bearings throughout.

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can serve you by air mail and air parcel post? Over 170,000 engineering texts, and files of every worthwhile periodical are available for further research to meet your specific needs—patents, design, research, construction, and management problems. Charges cover only the cost of the services and represent but a fraction of the value you will receive.

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Please send me information pamphlet on services available, how air mail can expedite them, and their cost.

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YOUR PLANT WITH

G-A SOLENOID VALVES

WHICH CAN BE OPERATED

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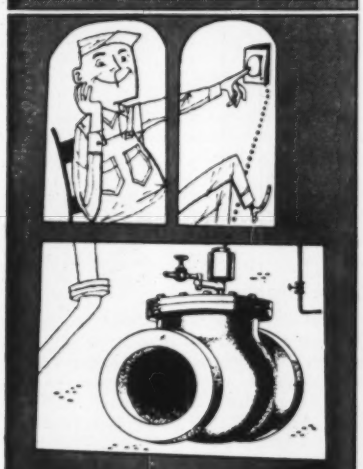

✓ or by many other types of electrical impulse

✓ Use the angle body and save the price of an elbow fitting

✓ Positive Control

✓ Sizes ½" thru 36"

✓ Used on Water, Oil, Air and Many Other Liquids

BULLETIN W-7 HAS THE TECHNICAL FACTS

WRITE FOR IT TODAY

GOLDEN ANDERSON

Valve Specialty Company

1223 RIDGE AVE., PITTSBURGH 33, PA.

Designers and Manufacturers of

VALVES FOR AUTOMATION

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The belt take-up is readily accessible, permitting quick and simple adjustment of the conveyor belt as required. The conveyor is furnished with a Neoprene-lined hopper at the intake to prevent the possibility of loss of small parts being fed to the conveyor.

For further information write for Bulletin B-504, Eriez Mfg. Co., Erie 6, Pa.

BUSINESS NOTES

Opens Detroit Office

Salem-Brosius, Inc., Carnegie, Pa., announces the establishment of a sales office for the handling of its mechanical equipment and materials handling equipment lines in the Michigan area. The office will be located at 15846 Monte Vista Ave., Detroit 38, Mich.

New Branch Office

Lincoln Electric Co., has announced the opening of a new branch office and warehouse in Denver, Colo., at 1224 Walnut St.

Appoints Representative

Roll Formed Products Co., Youngstown, Ohio, manufacturers of continuously rolled metal shapes, has appointed The Fehlenberg Co., 606 Choutou Bldg., 4030 Choutou Ave., St. Louis, Missouri, to represent the firm in the central Mississippi Valley states. The new addition to the sales organization will cover Missouri, Eastern Kansas, Southeastern Nebraska and Southern Illinois.

Opens Branch Office

Arthur D. Little, Inc., consulting research firm of Cambridge, Massachusetts, opened a branch office in Washington, D.C. The office is in Suite 606, the Cafritz Bldg., at 1625 Eye St., N.W.

New Laboratory Facilities

Inland Testing Laboratories, 1457 Diversey Pkwy., Chicago, Ill., announces completion of its new branch laboratories at Dayton, Ohio. The building is completely air-conditioned, and provision is made for future expansion. The facility is undertaking immediately, qualification and endurance testings principally for the Air Force and its contractors.

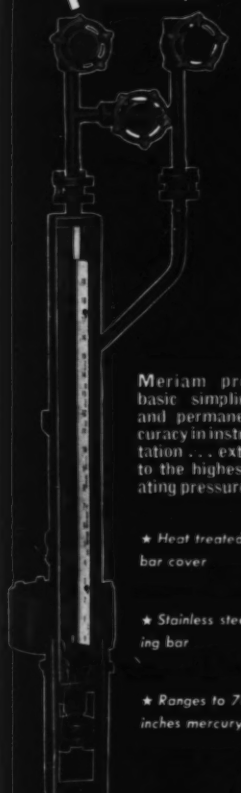
Five New District Offices

Establishment of new district offices in Youngstown, Ohio; Wichita, Kan., San Antonio, Tex., Evansville, Ind., and Nashville, Tenn., has been announced by American Blower Corp., Detroit 32, Mich. The five new locations will expand to 53 the number of American Blower district offices for providing assistance to users of air handling, heating, air conditioning and fluid drive power transmission equipment and refrigerating machines in the United States.

UNMATCHED ACCURACY

at highest working pressures

At pressures up to 2000 psi, this Meriam Manometer provides critically accurate flow or differential pressure measurement. Constructed of solid bar stock steel, all parts are precision fitted, hand lapped. Each unit is cold hydraulic tested to 5000 psi.



Meriam provides basic simplicity . . . and permanent accuracy in instrumentation . . . extending to the highest operating pressures.

★ *Heat treated glass bar cover*

★ *Stainless steel backing bar*

★ *Ranges to 70 inches mercury*

Write for Bulletin C-12.

Meriam Manometer Instrumentation

. . . for pressures, vacuums, flows, liquid levels.

meriam

INSTRUMENT COMPANY

10920 Madison Ave. · Cleveland 2, Ohio

NEW PRIME DEVELOPMENT PROJECT at The Garrett Corporation

Newly formed Rex division has immediate openings for Turbomachinery Specialists — unusually interesting, unusually promising.

This is a prime development program which will interest Turbomachinery Engineers who welcome a "ground floor" opportunity with no ceiling on advancement.

This new Garrett division has tremendous growth potential for the engineering staff now being formed.

If you are qualified by experience, are eligible for secret clearance, and are interested in any of the following categories in design, development or drafting, please write for further information to: Robert L. Ehinger, Rex Division, 9851 So. Sepulveda Boulevard, Los Angeles 45, California.

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MECHANICAL CATALOG

Published annually as a service to members by

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

29 West 39th Street, New York 18, N. Y.

Forms New Division

North American Aviation has announced establishment of the Autonetics Div. for continuation of its engineering and manufacturing operations in the electro-mechanical field. Developed from engineering studies inaugurated nearly ten years ago in relation to the company's program of guided missile development, North American's work in electro-mechanics has grown into an operation now employing nearly 8000 people. The new division is engaged in the development and production of automatic navigational systems for both missiles and aircraft, autopilots, automatic flight control systems, airborne armament control systems, radar systems, analog and digital computers, data processing equipment and precision automatic controls for machine tools.

Opens Oakland Office

A branch office in Oakland, Calif., has been opened by the Ralph C. Coxhead Corp., manufacturer of office composing machines. It is located at 528 Grand Ave., and will have complete facilities for the sale of Vari-Typers, Coxhead composing machines and Coxhead liners, as well as full service facilities, and an operator training program.

Motor Distributor

Holtzer-Cabot Motor Div., National Pneumatic Co., Inc., Boston, Mass., announces the appointment of Rockbar Corp., New York, N. Y., as sales representative for Holtzer-Cabot motors in southern New York, northern New Jersey and Fairfield county, Conn.

Establishes Western Division

Norden-Ketay Corp., has established a Western Division in Gardena, Calif. to provide extended, more efficient and effective service to customers in the West. The division consists of two plants, one in Gardena, the other in nearby Hawthorne, Calif. Together the plants comprise a completely self-contained, self-sufficient unit of 30,000 sq ft, fully equipped for research, design, development and quantity production of synchros and resolvers and of many other high precision electro-mechanical devices and components for control and computing systems. They will also provide full research, development, engineering, and sales services.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

New Houston Plant

Well Equipment Mfg. Corp., an operating division of Chiksan Co., has announced plans for the manufacture of swivel joints and flexible line assemblies in a new plant to be constructed in Houston, Tex.

The expansion will provide a second manufacturing source for the company's swivel joints. The division's present Houston plant manufactures wing unions, snatch blocks and other specialty items for the petroleum industry. Swivel joints are now produced in the company's main plant in Brea, Calif.

LATEST CATALOGS

Stainless Steel

Allegheny Ludlum Steel Corp. is now distributing a new Blue Data Sheet on Stainless Steel Type 301.

Type 301 is an austenitic steel with a nominal composition of 17 per cent chromium and 7 per cent nickel. It is used primarily in structural applications, automobile trim, show cases, stove fronts and cooking utensils.

The data sheet gives detailed information on physical properties, resistance to corrosion, resistance to oxidation, mechanical properties and other important figures and charts.

Copies of the new Blue Sheet can be obtained on request from the Sales Dept., Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa.

Flexible Metal Hose

A 12-page, two-color, illustrated catalog, No. 152 on the complete line of Flexon Flexible Metal Hose has just been released by flexonics Corp.

The full range of flexible metal hose products are covered along with complete coupling data. An easy four-step metal hose selection guide is included. For copies, write Flexonics Corp., 1305 South 3rd Ave., Maywood, Ill.

Flattening Mills

A new 12-page, illustrated booklet published by Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. gives details on the wide range of 2-high wire flattening mills and auxiliary equipment produced by the company.

The booklet points out that this equipment is custom-engineered for specific applications in flattening ferrous, nonferrous and clad metal wire in diameters from a few thousandths of an inch up to one inch at speeds approaching 3000 fpm.

Free copies of this booklet can be obtained by requesting circular No. 731-R from Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

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Ruthman Gusher Coolant Pumps Are Adaptable

Illustrated is a Gusher Coolant Pump mounted on Beco Model #410 Automatic Drilling and Tapping Machine.

Photo Courtesy Batchelder Eng. Co., Inc.

Gusher Coolant Pumps readily lend themselves to novel and unusual applications. On the Beco Model #410 automatic drilling and tapping machine, the Gusher Coolant Pump is mounted on roller drawer slides for quick and easy exchange of coolants. On all coolant pump problems you can depend on Gusher Coolant Pumps.

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KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Light Metals Heating

A technical bulletin describing furnaces for the heating and heat treatment of aluminum and other light metal alloys from the ingot to the finished product has been issued by Surface Combustion Corp., Toledo 1, Ohio.

The bulletin covers types of furnaces, both batch and continuous, including soaking pits, coil annealers, continuous process roller hearth furnaces, batch type units for heat treating, and melting, as well as investment casting. New data on extremely rapid heating with high speed convection are presented.

Precision Spring Design

A third series of selected data sheets, dealing with basic considerations in the design of precision springs, is offered by the Hunter Spring Co., Lansdale, Pa.

Residual stresses, stress concentration, design stress, fatigue life and the effects of elevated temperatures are discussed and illustrated in the 10 pages of two-color data sheets, designated "Section 1A." They are designed for loose-leaf filing.

Industrial Trucks

"How to Figure Your Industrial Truck Costs" is the subject of a four-page folder now available from the Elwell-Parker Electric Co.

The literature, a reprint of a feature article, covers the two most important phases of cost investigation: the cost of truck ownership and truck operation. With such factors in mind, information is then offered on methods for lowering operating costs.

Copies of this folder may be obtained from The Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, Ohio.

Refractory Specialties

The Ramtite Co., Div. of The S. Obermayer Co., 2563 West 18th St., Chicago 8, Ill., recently issued a new 16-page catalog describing plastic and castable refractories, cements and mortars from packaging to completed installation. It also outlines many applications in ferrous and nonferrous metal furnaces, aluminum reverberatory melting furnaces, annealing ovens and heat treating furnaces. Typical applications and suggestions on how to use plastics, castables, cements and mortars, are also included.

Metal Parts Forming

A new booklet available from the Grotnes Machine Wks., 5454 N. Wolcott Ave., Dept. 120—16, Chicago 40, Ill., explains the principles of forming metal parts by expanding, shrinking and roll forming in an integrated and unique method, producing such parts as auto and truck tire rims, metal containers, jet engine parts, home appliance parts. The booklet also sums up the company's history of more than 55 years in pioneering metal working machines for industry throughout the world.

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"Engineering News"

Vol. 7, No. 2, of the "SK Engineering News" has been published by Schutte and Koerting Co.

Features of this issue include an article on SK heat transfer apparatus covering new types, modifications, and features of this line of equipment; a concise review of a recently published bulletin, V-1, which describes, in condensed form, SK valves for power and industrial use; an applicatiou article on safeguard rotameters and how they are used to control ammonia flow at Publicker Industries; a story illustrating how fume scrubbers eliminate obnoxious varnish fumes in the plant of a large paint company; and a description of a "tank type" pump set designed for use as a fuel pump for power plants and for lubricating oil applications.

This issue also contains a table in which fume scrubbers available from SK stock are noted. Copies of the "SK Engineering News" can be obtained by writing to Dept. *G-A*, Schutte and Koerting Co., Cornwells Heights, Bucks County, Pa.

Air Cylinder

A new 12-page heavy duty air cyclinder catalog, has been released by Petch Mfg. Co., 463 York, Detroit 2, Michigan. Petch cylinders are particularly adapted to automation, die work, die automation conveyor applications; foundry, press and welding equipment; machine tools and fixtures. Complete engineering drawings and specifications are included on all five interchangeable mountings (foot, clevis, trunnion, blind end flange, rod end flange). Other features of the petch design are: oversize piston rod (hardened); "Petch" cartridge (seal, wiper and bearing); steel heads and caps; double ports each head (specify location); full piston cups for maximum sealing and wear; "Petch" originated floating cushions; interchangeable cushion screw and ball check assembly; conformance to current automotive NC-1 Standards.

Carbide Grades

Adamas Carbide Corp., of Kenilworth, N. J., has made available a four-page booklet, describing its complete line of tungsten carbide grades.

Divided into four sections, this booklet covers straight carbide grades for machining cast iron, nonferrous, and nonmetallic materials; steel cutting carbide grades; carbide for die applications and special purpose grades, including some of the newer carbide grades used in mining and rock-drilling applications.

Included in the folder are physical and chemical data on each of the grades, together with chemical analyses of some types of Adamas materials. Featured also are tables which Adamas has compiled to guide the carbide user in his selection of carbide grades.

Write Department F-21, for folder entitled, "Adamas Tungsten Carbide Grades."

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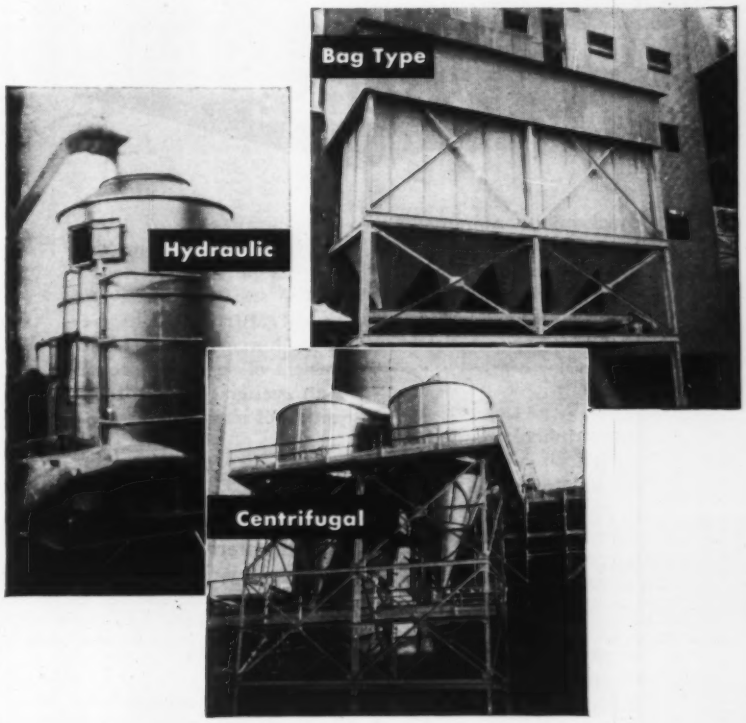

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Silicone Guide

The completely new 1956 Reference Guide to Dow Corning silicone products has just been published. The new edition describes almost 150 of the most generally used silicone products, 18 of which were first introduced within the last 12 months.

As in the past, the products are grouped by physical form (fluids, compounds, greases, resins and rubbers) and cross-indexed by usage (dielectrics, defoamers, damping media, etc.), enabling them to be located by what they do, as well as by what they are.

Illustrated with charts, tables, graphs, and application photographs, the catalog may be obtained by writing Dow Corning Corp., Midland, Mich.

Bellows

Stainless steel bellows-duct components and bellows assemblies for turbo-jet and turbo-prop aircraft are described in new literature from Arrowhead Rubber Co., 2330 Curry St., Long Beach, Calif. Bulletins are devoted to the application and operation of bellows tie-rod assemblies, braid covered bellows, and pressure compensating chambers. Bellows design data and formulas are offered as an aid to engineering a balanced tension system into rigid metal ducting to compensate for pneumatic-thermal duct thrust.

Gage Blocks

A new 36-page catalog describing Webber gage blocks and accessories is announced by Webber Gage Co. The catalog contains photographs, line drawings, charts and detailed descriptions of the company's line of linear and angular gage blocks and accessories, optical flats, interferometers and temperature meters. Four new, important additions to the Webber line are also included.

In addition, the catalog features a section describing Webber's method of attaining millionth-of-an-inch accuracies, and another section on the care and handling of gage blocks.

Write for Catalog No. 56 to Webber Gage Co., 12912 Triskett Rd., Cleveland 11, Ohio.

Gas Feeder

A low-cost volumetric chlorine gas feeder, equipped with automatic safety features, and combining the qualities of accuracy and dependability, is described in a four-page bulletin just issued by Builders-Providence, Inc., a division of B-I-F Industries, Inc., Providence, R. I.

Informative sections on the operation, description, methods of control, safety features, plus photograph and flow diagrams are included in the bulletin. Model EVS Chlorinizer controls and meters gas under vacuum, producing and delivering chlorine-water solution to the point of application.

For further information write Builders-Providence, Inc., 345 Harris Ave., Providence, R. I.

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Fluid Drives

A new illustrated catalog, Bulletin 9619, describing the new Type VS Class 2F Gyrol fluid drive for diesel engine applications is now available from American Blower Corp., Detroit 32, Mich.

The new catalog describes construction and operational features of the Class 2F adjustable speed fluid drive as applied to diesel engine installations. Operating characteristics are described in detail for such oil field machinery as draw works, rotary and slush pumps. The use of the new units in compounding multiple engine drives is also discussed. Typical installation photos are also included.

A two-color section drawing in the new catalog is accompanied by a detailed explanation of how the Gyrol fluid drive works. Outstanding features are listed and discussed. Also included in Bulletin in No. 9619 are specifications and installation drawings giving typical dimensions of Class 2F units. A special table of oil cooler selection recommendations is also part of the new catalog.

Sewer Pipe

"Transite Sewer Pipe with Ring-Tite Coupling" is a new 8-page booklet just issued by Johns-Manville.

It illustrates and explains economies which this asbestos-cement pipe can effect in the design, installation, operation, and maintenance of a sewer system. It shows how the Ring-Tite coupling makes tight joints more quickly. It covers related items such as the Transite sewer pipe fittings for connecting to Transite building sewer lines. The booklet concludes with a table of sizes, weights, and crushing strengths on the back cover.

Copies of the booklet are available from Johns-Manville, 22 East 40th St., New York 16, N. Y.

Air Meter

A new bulletin on the recently developed "Pushbutton" Anemotherm air meter has been announced by the Anemostat Corp. of America, 10 E. 39 St., New York, N. Y. The Anemotherm is a self-contained, portable unit for measuring air velocity, air temperature and static pressure in heating, ventilating and air conditioning systems. It may be used in ducts, free spaces, and at air inlets and outlets, and is suited for both field and laboratory work.

The bulletin explains the operation of the Anemotherm and describes typical uses for it, in various types of systems. A number of photographs illustrate the time-saving and precision control features of the unit, and outline operating procedures.

The new air meter measures velocity from 10 to 8000 fpm in increments as small as 5 fpm, temperature to 225 F with an accuracy of about one-half of a degree, and static pressure directly in terms of inches of water from 0 to 8 negative and positive with a sensitivity of better than .05 in. at lower range.

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Carbon (C)	6.05-6.15%	19.20-19.60%	9.20-9.40%	6.35-6.55%
Columbium (Cb)				5.00% (max)

*Including CbC

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Free Carbon	0.05%	0.20%	0.05%	.....
Fe	0.15%	0.40%	0.10%	0.10%
Mo	0.10%	.....	0.30%	.....
Ni	.....	.....	0.20%	.....
Cb+Ta	0.50%	.....	0.50%	.....
Ti	0.20%	.....	.....	0.50%
Si	0.10%	0.10%	0.10%	.....
Mn	0.10%	0.10%	0.10%	.....
V	.....	0.10%	.....	.....
Zr	.....	.....	.....	0.20%
Sn	.....	.....	.....	0.10%
W	.....	0.20%	.....	0.30%
Cr	.....	0.10%	.....	.....
N_2	.....	0.30%	.....	.....

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Electrical Conductivity (% of Copper Standard)	4.3-10.0
Coeff. Thermal Expansion ($\times 10^{-6}$/°F up to 1200°F)	2.5-4.0
($\times 10^{-6}$/°C up to 650°C)	4.5-7.2
Magnetic Permeability (μ Induction)	1.5-3.0

RANGE OF MECHANICAL PROPERTIES OF VARIOUS GRADES

Hardness (Rockwell A)	85-93
Hardness (Rockwell C)	67-82
Hardness (Knoop-K100)	1700-2100*
Transverse Rupture (psi)	175,000-385,000
Young's Modulus of Elasticity (psi)	61,600,000-94,300,000
Compressive Strength (psi)	518,000-800,000
Torsional Strength (Shearing Stress psi)	100,000-186,000
Tensile Strength (psi)	To 150,000

*Partial Range

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Purge Meter Bulletin

An illustrated eight-page bulletin in color describing the firm's line of purge meters for convenient, dependable small flow indication, is available from Brooks Rotameter Co., Lansdale, Pa. Application data, design, and construction details and capacity charts are included.

Aluminum Bronze Alloys

WW Alloys, Inc., Div. of Fansteel Metallurgical Corp., 11696 Cloverdale Ave., Detroit 4, Mich., has issued a 32-page booklet on premium quality aluminum bronzes.

Included in the booklet is information on the properties, composition and functions of aluminum bronze alloys as furnished by the company in sand, centrifugal, investment and permanent mold castings, hammer forgings and heat-treated and machined parts. Engineering data on each grade of aluminum bronze, a specification index chart, drawings and tables of machining recommendations, information on engineering and metallurgical consultation services and a pictorial description of the company's foundry and machine shop facilities are included.

Steel Data Sheet

Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa., has issued new additional information on its "Ontario-EZ Free Machining Air Hardening Die Steel." A Blue data sheet is now being distributed on this steel.

Ore Crush Resistance

"Measuring the Crushing Resistance of Rocks and Ores" is the title of a booklet published by Pennsylvania Crusher Div., Bath Iron Works Corp., West Chester, Pa.

Methods and means for measuring the crushing resistance and abrasiveness of rocks, minerals, and ores are discussed in detail.

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Heat Exchangers

A catalog is available from Carl Buck & Associates, Essex Fells, N. J., giving data on Camac heat exchangers for plating, pickling and anodizing solutions.

Listed are all solutions used and proper materials of construction to give satisfactory performance. Included are formulas for determining the size of unit needed for any heating or cooling load. Simplified heat loss and steam temperature tables as well as dimensioned sketches facilitate selection of proper unit for controlling temperature in any metal finishing process bath.

Hard Surfacing Alloys

Coast Metals, Inc., Little Ferry, N. J., has issued literature on hard surfacing tube rods for manual and automatic welding.

Data is given on the abrasion, impact, corrosion, heat and machineability characteristics of five tube rods of different compositions.

Precision Potentiometer

Borg Equipment Div., George W. Borg Corp., Janesville, Wis., has published a brochure covering all phases of precision potentiometer design and application.

Information, graphs and charts covering physical and electrical characteristics are included in the bulletin entitled, "A Symposium of Technical Articles."

Condenser Tubes

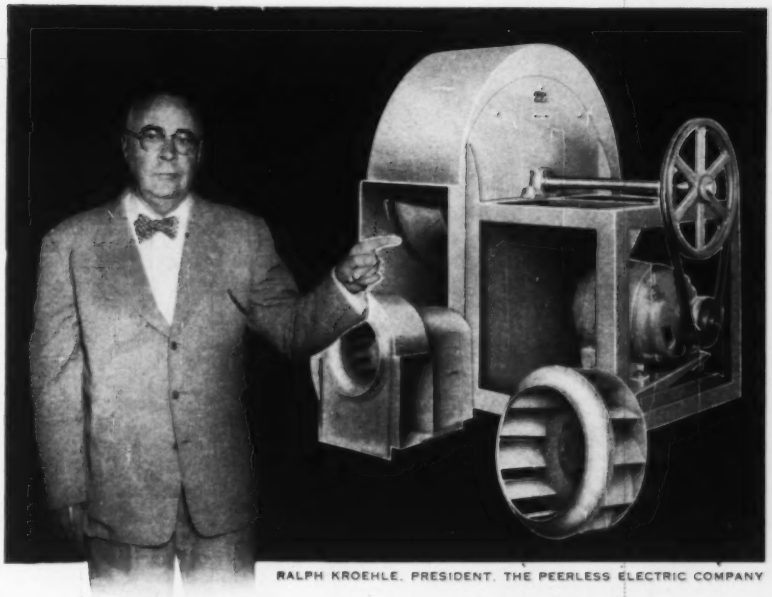
An eight-page technical folder on heat exchanger and condenser tubes has been issued by Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.

This bulletin, identified as TB-329B, covers information on the popular grades of carbon, alloy and stainless steel heat exchanger tubing, both seamless and welded. The bulletin also includes a special section dealing with the problems of installing heat exchanger and condenser tubes by the expanding method.

Rigid Vinyl Pipe

Alpha Plastics Inc., 15 Northfield Rd., West Orange, N. J., offers two bulletins on selection of its unplasticized, rigid pvc pipe and fittings.

Two types of pipe are described, together with charts showing their mechanical, thermal, electrical and other desirable properties. Also introduced, is the manufacturer's new, pressure-rated, Schedule PR-150 rigid pvc pipe which offers the same working pressure in every size, from ½ to 4 in. Installation data, plus a chart listing the industries where rigid, corrosion-resistant pipe is recommended, is included. A special table shows the pipe's resistance by field tests, to a wide range of frequently encountered, "problem" chemicals. Installation procedures are also described. Companion folder describes and illustrates threaded and socket solvent cement fittings.



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PERFORMANCE DATA— Complete data on Peerless fans and blowers is cataloged for easy reference. Bulletin SDA-160 shows all fans and forward curve blowers. Bulletin SDA-200 gives all data on backward curve blowers (NAFM) from 12½" to 36½". Write for your file copy. Dimension prints are available on request.

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KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Abrasive Belt Grinding

"How Abrasive Belt Grinding Increases Production," a new 31-page booklet consisting of 46 illustrated case histories, has just been announced by the Engelberg Huller Co., 813 W. Fayette St., Syracuse 4, N. Y.

Application studies are grouped according to each of five types of abrasive belt machining: platen, contact wheel, formed wheel, centerless, and flexible belt. Materials covered include ferrous and nonferrous metals, glass, wood and plastics. Each abrasive belt grinding illustration is accompanied by a close-up shot of the ground parts.

Thermocouple Wire

A 12-page engineering bulletin, No. 1701, listing conductor specifications and recommended insulations for various operating temperatures of standard thermocouple wires is available from Revere Corp. of America, Wallingford, Conn. Included are thermocouple wires built to military specifications and data on wire resistances, weights, emf.

Vibrating Feeder

Richardson Scale Co., Clifton, N. J., announces a four-page bulletin describing its Velofeeder, a new mechanical vibrating feeder. It is designed to facilitate a steady flow of any loose bulk material into such processing machinery as automatic scales, grinding mills, pulverizers, mixers, conveyors, elevators and packaging machinery.

The bulletin outlines the operating principles and specifications of the feeder, which can be electronically synchronized to match the flow-speed of other equipment. Nine photographs show the device actually feeding a variety of materials, and a full-page engineering drawing details its design.

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NEW EQUIPMENT
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Heat in Hydraulics

An eight-page bulletin, "Heat: Its Generation and Natural Dissipation in Hydraulic Circuits," offered by Oilgear Co., 1555C W. Pierce St., Milwaukee 4, Wis., features information on heat transfer area, oil circulation rate, auxiliary pumps, power pumps and pipes and valves. Also included are charted test results that should be of assistance in the engineering, installation, and operation of fluid power in industry.

Vacuum Degasser Data

Kinney Mfg. Div., New York Air Brake Co., 3640 Washington St., Boston 30, Mass., offers bulletin No. 402 which describes its new mobile vacuum degasser for purifying molten metals.

The completely self-contained unit, said to be the first one commercially available, occupies less than 6 sq ft of floor space and rolls easily on wheels to any plant location. Through effecting purer metals, the degasser makes possible higher grade castings at low cost, the company says. The color brochure describes the component parts of the unit, dimensions, and seven specific advantages offered to foundry operators.

Process Pump Bulletin

A 20-page, two-color process pumps bulletin, describing vertically split, single stage and two stage type process pumps, is available from Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

Included in the bulletin are design features of the pumps, dimension tables, cross sectional and installation views, plus a two page chart showing the extensive interchangeability of parts through the entire line of pumps. The units are built in accordance with latest API specifications. The range of coverage is from 1 to 8 in. including capacities to 3200 gpm, heads to 925 ft., at temperatures to 800 F.

Copying Equipment

A 12-page brochure describing the versatility of xerography in preparing masters for offset, diazo, spirit and other fluid type duplicating, has been released by the Haloid Co., Rochester 3, N. Y.

The brochure illustrates and describes the company's line of copying equipment for specific applications of all kinds of paperwork duplicating. It shows how xerography provides speed, accuracy and low cost operation.

Nuclear Test Reactor

General Electric Company's Atomic Power Equipment Dept., Schenectady 5, N. Y. has announced a new bulletin detailing operation of its light-water and oil-moderated nuclear test reactor, using heterogeneous-enriched fuel. The bulletin, GER-1123, depicts through description, drawings and photographs the design features and construction of the reactor. It also lists many of the uses of the reactor.

Pangborn Dust Control

Saves $14,000 a year for Woodall

The Long Island plant of Woodall Industries, Inc., had a serious problem. Fabricating Masonite for its hundreds of products released so much dust that, without efficient dust control, work would be practically impossible. So Woodall installed a Pangborn Dust Control system.

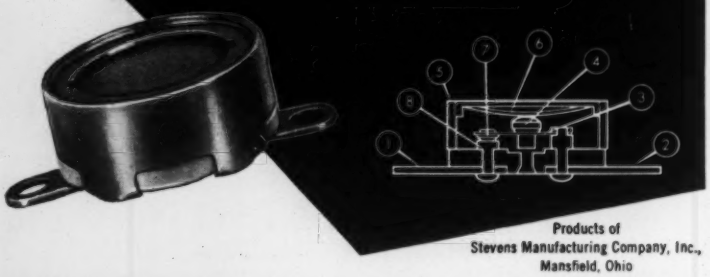
The result? The dust collected not only leaves the plant dust-free but provides *all* the fuel for heating and processing requirements. Savings on fuel bills amount to $14,000 a year! Pangborn Dust Control at Woodall pays its own way *with a profit* for the firm.

Pangborn can solve *your* dust problem. Pangborn engineers will be glad to show you how Pangborn Wet or Dry Dust Collectors can save you time, trouble and money!

See how Pangborn benefits varied industries. Write for free copy of "Out of the Realm of Dust." Pangborn Corp., 2200 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control and Blast Cleaning Equipment.*

Pangborn CONTROLS DUST

How Chace Thermostatic Bimetal Actuates



Products of
Stevens Manufacturing Company, Inc.,
Mansfield, Ohio

STEMCO TYPE A THERMOSTATS

Stevens Manufacturing Company produces standard designed thermostats in a wide variety of types to accommodate volume production applications. Stevens-built thermostats are universally recognized for accurate performance and long service life and are to be found in leading makes of household appliances, electronic equipment, industrial control apparatus, etc. — wherever sensitive thermally responsive regulation is required.

One of the many Stevens thermostat designs which employs Chace Thermostatic Bimetal is the Stemco Type A, used to make and break circuit upon temperature change (either increase or decrease), within a range of −40° to +400° F.

In the *make* position, current flows from terminal (1) to terminal (2) through contact spring (3) which is held closed by insulator button (4). Heat from the controlled device is transmitted to the bimetal thermal element by two means: first, by conduction through the metal housing (5) which is in contact with the device; and second, by radiation because bimetal disc (6) is in close proximity to the controlled surface. When preset temperature is reached, the bimetal disc snaps to reverse curvature. Since pressure on the contact spring is released, contacts (7, 8) quickly separate to break the circuit. As temperature drops to a predetermined point, bimetal snaps contacts *closed* again.

Chace Thermostatic Bimetal is available in 29 different types, in strip, coils, or in complete elements fabricated to customer specification. Write now for 36-page booklet, "Successful Applications of Chace Thermostatic Bimetal," containing information of value to designers of thermally responsive devices.

IT BENDS WITH THE HEAT

W. M. CHACE CO.
Thermostatic Bimetal
1619 BEARD AVE., DETROIT 9, MICH

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Totalizing Counter for Scales

A technical reference on analog-to-digital conversion in automatic weighing is now offered by Richardson Scale Co., Van Houten Ave., Clifton, N. J.

The two-page reference describes how a semi continuous weigher, with dial scale, operates a counter which provides a cumulative indication of pounds of material weighed as the weigher discharges. The process is said to be particularly applicable to difficult, non free flowing, adhesive materials and may be used in receiving, shipping, process or inventory control operations. A typical sequence of operation is described and illustrated with two schematic drawings. Salient features described in the bulletin include the totalizing mechanism, an optional recording device, manual operation features, depth of stream regulator and a control panel.

Press Brake Catalog

A new catalog describing Steelweld press brakes has been issued by Cleveland Crane & Engineering Co., Wickliffe, Ohio.

Construction details are described and illustrated. Dimensions and specifications are given for the entire standard line of press brakes which range in bending capacity to 14 ft × 3/4 in. mild steel.

Segregating Slide Valves

Allen-Sherman-Hoff Co., 259 E. Lancaster Ave., Wynnewood, Pa., announces the availability of its new data sheet, Ua, covering the company's line of slide gate type of segregating valves for pneumatic materials handling systems.

This four-page bulletin describes the application, design, and operation of these valves, and gives installation instructions together with dimension drawings and tables. Illustrated in the bulletin are the various models available for automatic or remote operation (with air cylinders), as well as for local manual operation (with either "push-pull" rods or chainwheels).

Special Cleaning Problems

The application of specially designed airless blast equipment to 56 production cleaning problems, such as those encountered with cast, welded, forged, heat treated and machined components used in automotive, railroad, ordnance, farm equipment and machinery is described in a new 34-page brochure published by Wheelabrator Corp., 1149 S. Byrkit St., Mishawaka, Ind. The booklet includes the following other categories of cleaning and finishing in its large collection: descaling of hot rolled steel strip, sheet, slabs, billets, and structural steel; etching steel mill rolls; cleaning tubing, soil pipe, steel drums, sanitary ware, and many other items. The shot peening process is also treated.

Continued on Page 75

Need more engineering information on products advertised in this issue?

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If you would like further engineering information on any of the products advertised in this issue, circle the page numbers of these ads on one of the cards below. . . fill in your name and address and mail to us. Your requests will be forwarded to the advertiser. The information will come directly to you.

(Note: This service does not apply to students.)

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FIRST CLASS
PERMIT No. 1144
NEW YORK, N. Y.

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3c POSTAGE WILL BE PAID BY

MECHANICAL ENGINEERING
29 West 39th Street
New York 18, N.Y.

MECHANICAL ENGINEERING — January 1956 issue

IFC	13	26	39	54R	67	89	105	115
1	14–15	27	41	55R	69	91	106–7	116TL
2	16	28–29	42	56	71	93	108	116TR
3	17	30	44	57	72	95	109	116B
4–5	18–19	31	45	58L	75R	97	110L	117
6	20	32	47	58R	77	98	111	118
7	21	33	48	59TR	80	99	112L	133
8–9	22	34	51	61L	82	100	112TR	135
10	23	35	52	61R	83BL	101	112BR	136
11	24	36	53	63BR	83BR	102	113	IBC
12	25	37	54L	65	85	103–4	114L	OBC

PLEASE SEND me more complete engineering information on the products advertised in the pages circled above.

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4–5	18–19	31	45	58L	75R	97	110L	117
6	20	32	47	58R	77	98	111	118
7	21	33	48	59TR	80	99	112L	133
8–9	22	34	51	61L	82	100	112TR	135
10	23	35	52	61R	83BL	101	112BR	136
11	24	36	53	63BR	83TR	102	113	IBC
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NAME .....

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ADDRESS .....

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FIRST CLASS
PERMIT No. 1144
NEW YORK, N.Y.

MAIL THIS CARD

after circling the page numbers and filling in your complete address.
NO POSTAGE REQUIRED

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

3c POSTAGE WILL BE PAID BY

MECHANICAL ENGINEERING
29 West 39th Street
New York 18, N.Y.

But why MEN over 45?

Our doctors still don't know *why*, but if you are a man over 45 you are six times as likely to develop lung cancer as a man of your age twenty years ago. They *do* know, however, that their chances of saving your life could be about *ten times* greater if they could only detect cancer long before you yourself notice any symptom. (Only 1 in every 20 lung cancers is being cured today, largely because most cases progress too far before detected.)

That's why we urge that you make a habit of having your chest X-rayed every six months, no matter how well you may *feel*. The alarming increase of lung cancer in men over 45 more than justifies such precautions. Far too many men die *needlessly!*

Our new film "The Warning Shadow" will tell you what every man should know about lung cancer. To find where and when you can see this film, and to get life-saving facts about other forms of cancer, phone the American Cancer Society office nearest you or simply write to "Cancer"—in care of your local Post Office.

American Cancer Society

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Belt Conveyor Carriers

Stephens-Adamson Mfg. Co., Aurora, Ill., announces the availability of a new belt conveyor carrier bulletin covering the company's line of standard units.

New addition to the line is a long center roll carrier with either 35 or 45 deg slope end rolls for greater carrying capacity on light materials, such as grain and wood chips. In addition, the new bulletin describes a number of special carrier units, as well as belt conveyor trippers and accessories.

Hand Forgings Data

Minimum mechanical property guarantees for all classes of hand forgings produced by Kaiser Aluminum & Chemical Corp., at its Erie, Pa., forging plant are charted in a new folder.

Designed for use as a wall chart, looseleaf insert, or self-contained filed folder, the folder tabulates tensile and yield strengths and elongation percentages of hand forgings made from aluminum alloys 2014-T6 and 7075-T5 in various sizes up to 2000 lb in weight. Quick-reference data is tabulated to cover individual specifications including those under AMS, federal and the firm's standard and special products hand forgings. The folder may be obtained from Kaiser Aluminum's Industrial Service Div., PR 355, 1924 Broadway, Oakland, Calif.

Worm Gear Bulletin

Engineering details on the assembly procedure for double-enveloping worm gearing are contained in a new 12-page bulletin available from Cone-Drive Gears Div., Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Mich.

The bulletin, CA-55, covers the latest methods of assembly using taper roller bearings, which are now standard equipment on both worm and gear shafts. The text is illustrated with engineering drawings and sketches. Color is superimposed on sketches to illustrate typical alignment conditions that result when the worm is blued and meshed with the gear. Instructions for correcting misalignment are included.

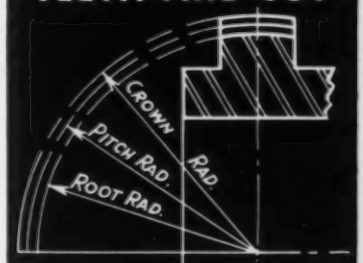
Industrial V-8 Engines

A new eight-page bulletin describing the company's industrial H540 and H844 V-8 engines has been published by the Le Roi Div. of Westinghouse Air Brake Co., Milwaukee 1, Wis.

The three-color bulletin uses 40 halftones, charts, drawings, and diagrams to illustrate the advance design, performance, and economy of these two engines, which operate on gasoline, natural gas, or LP gas. The H540 is rated at 190 hp, the H844 at 285 hp. Both engines are described as of modern, short-stroke design and built to withstand the rugged, heavy-duty service required of industrial, generator service, oil field, and irrigation applications. They are short in overall length, light in weight.

Here's the Big **DIFFERENCE**

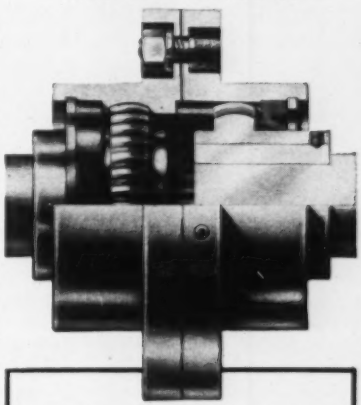
TEETH ARE CUT



ON A TRUE ARC

SPHEREFLEX®

COUPLING



SPHEREFLEX tooth design features an exclusive curved root and spherical tooth flank. Both angular and linear (parallel) misalignment are compensated for, since every portion of each gear tooth is actually a segment of a sphere. This special design eliminates all possibility of tooth interference and permits increased deflection between mating members. Full and uniform line contact, through the working depth of the tooth, insures a stronger coupling between driver and driven shafts; eliminates point rolling contact between gears during flexing; compensates for shaft misalignment up to 14° included angle. Send for Catalog C-560

PHILADELPHIA GEAR WORKS
INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
BALTIMORE • CLEVELAND
Virginia Gear & Machine Corp., Lynchburg, Va.
Industrial Gears & Speed Reducers • LimiTorque Valve Controls
Established 1892

SANDIA
CORPORATION

invites well-qualified
ENGINEERS AND SCIENTISTS
to investigate
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NUCLEAR WEAPONS
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SCIENTISTS:
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SANDIA CORPORATION, a subsidiary of the Western Electric Company located in Albuquerque, N. M., is engaged in the design and development of nuclear weapons under contract with the Atomic Energy Commission. Compensation is competitive with that offered in other industry, and employee benefits include exceptionally liberal paid vacations, free group life insurance, sickness benefits, and a generous contributory retirement plan. Interview and liberal relocation expenses are paid by Sandia Corporation. Albuquerque, center of a metropolitan area of 186,000, is located in the Rio Grande Valley, one mile above sea level. Urban shopping facilities, scenic beauty, historic interest, year-round sports, and sunny, mild, dry climate make Albuquerque an ideal home. Housing is readily obtainable.

WE WILL WELCOME THE OPPORTUNITY TO SEND YOU FULL DETAILS ON CURRENT CAREER OPPORTUNITIES

STAFF EMPLOYMENT DIVISION 553
SANDIA CORPORATION, Albuquerque, N. M.

Please send additional information on career opportunities at Sandia to:

NAME: _____

DEGREES: _____

FIELD: _____

EXPERIENCE IN FIELD: _____ **YEARS.**

ADDRESS: _____

If you wish to submit a more complete resumé of your qualifications, we will be happy to give it full consideration immediately.

SANDIA CORPORATION

ALBUQUERQUE, NEW MEXICO

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Piston Packing Data

A 16-page data bulletin on Pumcups for packing pistons of air cylinders, hydraulic cylinders and reciprocating pumps has been released by the manufacturer, Darling Valve & Mfg. Co., Williamsport, Pa.

Included are operating diagrams and a list of typical installations, as well as data on the full range of Pumcup compositions, textures and types made available for specified pressure, temperature and corrosive conditions. The proper compositions are identified for many specifically listed fluids, various gases, acids and alkalies. Also included are tables giving the complete range of standard sizes and prices.

Standard Conversion Tables

A new bulletin, "Standard Conversion Tables" F7255, giving thermocouple temperature-millivolt equivalents, is available from Barber-Colman Co., Rockford, Ill. Temperatures are expressed on the international temperature scale of 1948. The electromotive force is expressed in absolute units.

Barometric Condenser

Ingersoll-Rand Co., Phillipsburg, N. J., has released a new bulletin, Form 9012-A describing its barometric steam condensers of the disk-flow and ejector-jet types.

The disk-flow type is a highly efficient design suitable for any barometric steam condenser application. The ejector-jet type is a simplified design suitable for use where the quantity of noncondensables is moderate and relatively clean cooling water is available. They are available in sizes to 120 in. diam that handle up to 12,000 gpm of cooling water.

Speed Collet Chucks

New speed collet chucks taking both collets and step chucks are described in a two-color bulletin, HS5, offered by Hardinge Brothers, Inc., Elmira, N. Y.

The speed chucks feature new ease in operation with rapid closing and opening of the collet or step chuck with a turn of the handwheel. The new chucks are available for tool room lathes, engine lathes, and grinders. A section of the bulletin also describes collets with new $1^{1}/_{16}$-in. capacity, as well as the step chucks and closers.

Aluminum Alloys

George Sall Metals Co., Inc., 2300 E Butler St., Philadelphia 37, Pa., is offering an illustrated booklet entitled "How to Melt and Cast Aluminum Alloys."

The article covers proper pouring temperatures, how to minimize drossing, how to de-gas the metal, how to avoid entrapment, gating and risering practices to eliminate solidification cracking, use of holding kettles and types of furnaces to use and not to use.

Continued on Page 78

How Hamilton helps get the work done

More service and accuracy per dollar with Four-Post wood tables

Table shown is No. 221A. But interchangeable drawer equipment and variety of top sizes mean a wide choice to meet practically every drafting department need.

Economy is only one factor in the popularity of Hamilton Four-Post wood drafting tables. Bases are carefully selected and seasoned hardwood—strong and steady for long, satisfactory service. Heavy legs are 2½ inches square for solid rigidity, their corners rounded for appearance and no-snag protection. Easy-running drawers have non-warping welded fiber bottoms. Key-stock basswood tops are smooth and square, will not warp nor develop cracks, holes or crooked edges. Standard 37-inch height and convenient adjustability make for fast, comfortable work and maximum draftsman-productivity.

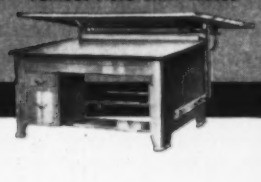
1. Key-stock basswood drawing surface
2. Zinc-plated steel end cleats
3. Firmly locking, easy-to-operate raising device
4. Long drawer for reference material
5. Tool drawer with lock and tray
6. Rigidly jointed 2½-inch-square legs

Write for the complete presentation of all Hamilton drafting tables, filing units and accessories—Catalog No. 14—without cost or obligation.

. . . also by Hamilton

Modern Steelwood tables

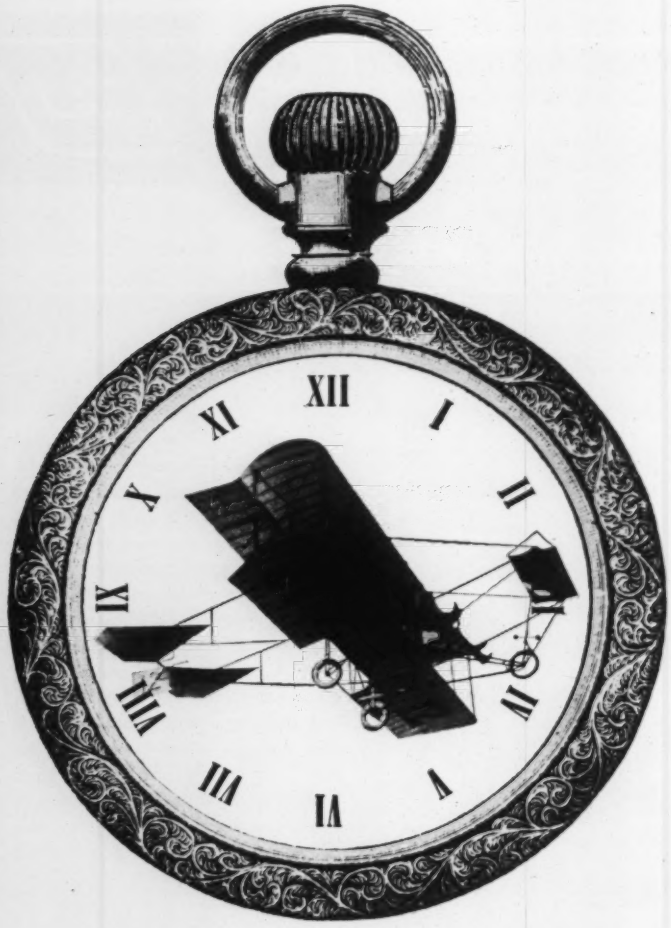
Famous Auto-Shift tables



Steel UnitSystem filing units

Hamilton DRAFTING EQUIPMENT

HAMILTON MANUFACTURING COMPANY
Two Rivers, Wisconsin



92,000 hours from now!

It is difficult to realize that this historic "flying machine" is just 92,000 working hours old.

From that 1910 beginning to today's new multi-jet Navy XP6M SeaMaster, Martin has developed and produced a new aircraft design every 1500 hours of the working calendar.

On this backlog of experience—unmatched by any other aircraft company in the world—one of the youngest and most dynamic managements in the industry is engineering new methods that are thousands of hours ahead of the aircraft calendar.

You would do well to find out what's happening at Martin—and what the opportunities there in AERODYNAMICS, ELECTRONICS, STRUCTURES, PROPULSION and NUCLEAR POWER might do to speed up your own calendar of progress.

Contact J. M. Hollyday, Dept. M-1, The Martin Company, Baltimore 3, Maryland.

MARTIN
BALTIMORE

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Tramrail Engineering Booklet

A new revised engineering and application booklet has been issued by the Cleveland Tramrail Div., Cleveland Crane & Engineering Co., Wickliffe, Ohio.

The booklet describes stresses developed in various type tracks used for overhead materials handling systems. The problem of track peening and its solution is also covered. Data is given on the principal components used for Tramrail systems. Illustrations show the equipment serving a wide variety of operations.

Powder Metallurgy

A new 18-page bulletin on powder metallurgy has been published by Keystone Carbon Co., St. Marys, Pa.

Sections include a summary of the powder metallurgy process, designing for powder metallurgy, typical applications, and details on the facilities and capacity of the company. Physical characteristics and chemical compositions of a number of ferrous and nonferrous production materials are included, along with a quotation check list.

Temperature Cabinets

Data on a line of temperature cabinets from 1 to 45 cu ft is contained in a new four-page bulletin released by Webber Engineering Corp., Dept. B- 200, P. O. Box 217, Indianapolis 6, Ind.

Temperature ranges are available from +300 F, using lifetime sealed electrical units to −200 F, by mechanical refrigeration. All temperatures are controlled in accuracy to plus or minus 0.2 F. Nine optional features are available in addition to 27 standard features.

Electrical Steel

A 28-page booklet on "Electrical Steel Sheets and Coiled Electrical Steel Strip," (Technical Bulletin EM 21) is now being distributed by Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa.

Included in the booklet is data on the electrical steels, detailed information on gage, performance guarantees, and detailed graphs on various technical aspects of these steels.

Protective Coatings

An illustrated catalog describing the firm's method of corrosion control has been issued by Amercoat Corp., 4809 Firestone Blvd., South Gate, Calif.

Protective coating systems are described which can incorporate corrosion resistance into a project, by planning for their use prior to construction. The various corrosion resistant coating systems manufactured by the company are outlined, as well as such additional services as guidance in choosing the proper protective coating, assistance in writing coating specifications and on-the-job inspections during application.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Synthetic Mica

Synthetic Mica Corp., Box 311, Clifton, N. J., announces the availability of data on the structure and composition of mica, physical properties of synthetic mica, various types of synthetic micas and potentialities of synthetic mica.

Included is a table on the dielectric properties of mica, both natural and synthetic.

Grinding Wheels

Norton Co., Worcester 6, Mass., has published a 22-page, illustrated booklet on the selection of wheels for precision grinding of tool and constructional steels.

Included are tables on the classification and nominal composition of principle types of tool steels, experimental grindability values, grinding wheel recommendations, and data on constructional steels.

Vibration Mountings

A new line of heavy-duty general purpose steel spring vibration mountings is described in a catalog just released by T. R. Finn & Co., Inc., 200 Central Ave., Hawthorne, N. J.

The vibration mounting combines the superior characteristics of steel springs with unique damping, sway and thrust control elements to achieve a degree of isolation said to be heretofore unobtainable in a single mounting. The catalog describes such construction details as cast semi-steel housing containing helical steel springs, rubber thrust bumpers, nylon dampers and steel base plate with sway control assemblies. A dual-purpose bolt secures the mounting to the machine and also provides quick and easy means of leveling.

Stainless Fastener Data

Allmetal Screw Products Co., Inc., Garden City, N. Y., has published a new two-color, 52-page stainless fastener data book.

First part of the book includes illustration, thread and size specifications, and availability in a variety of corrosion resistant metals of 40 basic fastening devices. The second part consists of engineering data relating to the composition, properties, applications, and weights of stainless steels, as well as other tables of interest to those concerned with fasteners.

Centrifugal Pumps

Five major advantages of Type HMC centrifugal process pumps with integral seal are outlined in a revised bulletin by Worthington Corp., Harrison, N. J.

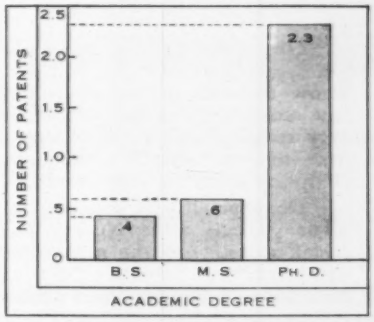
Information is presented on single stage vertically split process pumps with capacities up to 1200 gpm and heads to 475 ft. Outline drawings show typical section of HMC refinery pump, type PTO balanced Duraseal, and type 2-B balanced John Crane seal. Charts list information on bearing assembly, flange data, materials of standardized construction, and interchangeability.

SIDELIGHTS ON THE SCIENTISTS *number* **2** *of a series*

How many patents per Ph. D.?

Some of the young fellows on our staff have been analyzing our files of personal data regarding scientists and engineers here at Hughes. What group characteristics would be found?

With additional facts cheerfully contributed by their colleagues they have come up with a score of relationships—some amusing, some quite surprising. We shall chart the most interesting results for you in this series.



Data obtained from a 20% random sample of the 2,200 professional engineers and scientists of Hughes Research and Development Laboratories.

In our laboratories here at Hughes, more than half of the engineers and scientists have had one or more years of graduate work, one in four has his Master's, one in 15 his Doctor's. The Hughes research program is of wide variety and scope, affording exceptional freedom as well as exceptional facilities for these people. Indeed, it would be hard to find a more exciting and rewarding human climate for a career in science. Too, the professional level is being stepped up continually to insure our future success in commercial as well as military work.

Hughes is pre-eminent as a developer and manufacturer of airborne electronic systems. Our program includes military projects in ground and airborne electronics, guided missiles, automatic control, synthetic intelligence. Projects of broader commercial and scientific interest include research in semiconductors, electron tubes, digital and analog computation, data handling, navigation, production automation.

RIGHT NOW *the Laboratories in Culver City, California, and the Missile Production facility in Tucson, Arizona, have positions open for engineers who are experienced in any or all phases of Test Equipment Design.*

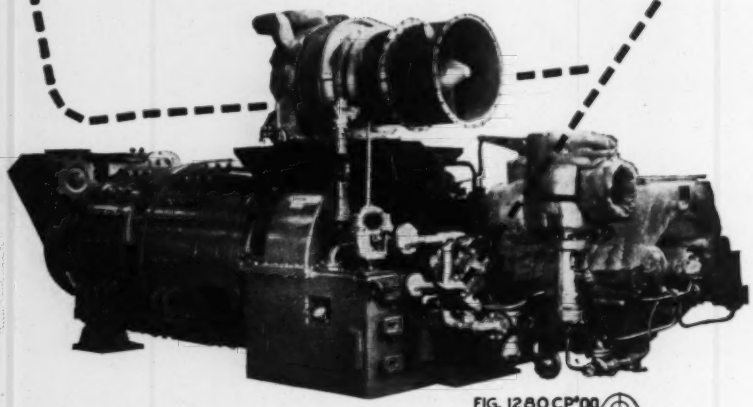
SCIENTIFIC STAFF RELATIONS

Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

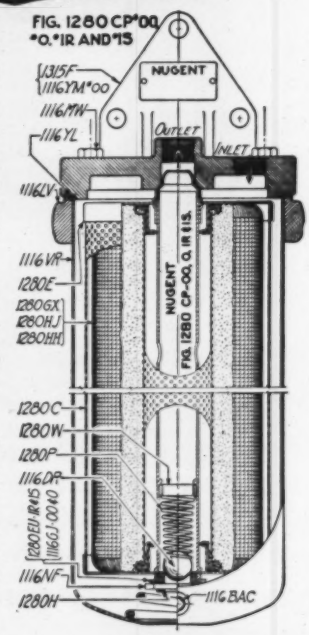
NUGENT FILTERS
Provide the Positive Protection
Fine Equipment Deserves



The turbogenerator shown above, power plant for the new Norfolk & Western 4500 H.P. experimental locomotive, is assured of maximum protection against mechanical breakdowns due to improper lube oil filtering. Installed on the unit is a Nugent 1280 CP size 1R Absorbent Oil Filter which effectively filters the main gear and pinion lube oil for the generator drive.

Operators of diesel engines, gas engines, turbines and other vital machinery know there is no substitute for safe, low cost, reliable filtering. For this very reason, *Nugent Filters are selected first*—to keep oiling and filtering systems in tip-top shape the year 'round.

Do yourself and your machinery a favor. Check some Nugent equipped installations. Ask the men who know first hand about the value of Nugent filters. Find out how Nugent filters protect your equipment and insure long life...how they offer *greater filtering area...increase engine dependability* and *do it at lower overall cost!*



For full technical details and specifications, write today outlining your filtering requirements.

Upper right: Sectional view of factory packaged "Throway" Nugent filter recharge.

Lower right: Nugent Fig. 1280CP Pressure Fuel Filter.

Wm. W. Nugent & Co., Inc.
409 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TUBESCOPE OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Industrial Paint

The versatility and wide application of Nubelite, a custom-formulated industrial paint finish for use on any metal product, is highlighted in a new, comprehensive brochure prepared and distributed by Glidden Co., Cleveland, Ohio.

The illustrated, 20-page brochure displays a wide range of Nubelite-finished consumer products including automatic washers and dryers, ironers, steel kitchen cabinets, water heaters, metal furniture, lighting fixtures, air conditioners, small appliances, metal desks, vacuum cleaners, and a host of other metal-made products for the home market.

Production Stamping

A line of 50- to 800-ton autofeed presses for high-speed production stamping with progressive dies is described and illustrated in a catalog offered by Danly Machine Specialties, Inc., 4358 W. Roosevelt Rd., Chicago 50, Ill.

The catalog explains how stampings can be turned out at a higher rate per hour and how to get the best efficiency out of costly progressive dies. Specifications include ton capacity, stroke, SPM range, shut-height, bolster size and thickness, bed opening, foot-to-bed height, slide adjustment, distance between uprights, horsepower, hand adjustment of slide, vertical upright opening, front-to-back upright opening, and all other significant dimensions.

Precision Gears, Boxes

Precision gears, gear boxes and pressure switches are described in a four-page, two-color illustrated brochure issued by Southwestern Industries, Inc., 5880 Centinela Ave., Los Angeles 45, Calif.

Miniaturized gear boxes for electronic and instrument applications, servo mechanisms, computers, small actuators, and electronic components, are described and illustrated. The firm manufactures and designs gear boxes in standard sizes and to customers' special requirements, and also makes spur and helical gears in all sizes less than 7 in. diam. The brochure describes miniaturized, vibration-resistant pressure switches for aircraft and missile systems applications.

Gamma Ray Projector

Bulletin P-196, available from Metal & Thermit Corp., 100 E. 42nd St., New York 17, N. Y., describes new Kel-Ray projectors for industrial radiography with gamma rays. Manufactured by the M. W. Kellogg Company, and sold exclusively by Metal & Thermit, the projectors are available in three sizes and offer a choice of radioactive isotopes of different intensity.

The four-page, two-color bulleting explains how the portability, safety, versatility and economy of the new gamma ray equipment expands the range of applications in which radiography may be used as a practical, economical tool for nondestructive testing.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Proportioning Control

Leeds & Northrup, 4907 Stenton Ave., Philadelphia 44, Pa., has announced as available a 14-page booklet illustrating and describing its new Series 60 electric proportioning control.

In the new units, rate and rest actions operate independently of each other. To prevent overshoot at start-up, automatic cutback of control action prior to reaching the control point is a standard feature. The booklet points out a unique case design which provides universal wiring between the recorder or indicator and control unit to permit easy changing from one type of control unit to another.

Tubing Bulletin

A new folder issued by the Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa., contains a complete listing of the type of tubing produced by the company and a brief description of various kinds of technical literature available on such specific types of tubular products as stainless and alloy tubing, stainless pipe, stainless sanitary tubing, heat exchanger and condenser tubing, boiler tubing, and mechanical tubing.

In addition, it contains a table of chemical analyses, physical properties, mechanical properties, and creep strength of 20 steels ranging from carbon steel through the stainless steels, which are used by the processing industries.

Induction Heating Bulletin

A descriptive bulletin on a general purpose scanner (Type GP) for scanning or single-shot heating of work pieces up to 30-in. long, 10-in. diam is offered by the Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

The bulletin explains the induction heat treating of a large variety of work. Shafts, axles, pinions, gears and other similar parts can be processed at high production rates and low power. The construction and operation of the general purpose scanner is listed in detail. Typical heating operations are also described.

Mylar Booklet

A new booklet showing latest commercial uses and detailed physical and chemical properties of Mylar polyester film has been issued by Du Pont's Film Dept., Wilmington, Del.

Illustrated with photographs and charts, the booklet cites examples of industries where this plastic film has now become a preferred material. Included is a chart detailing the characteristics of Mylar which have permitted design improvements and cost reductions in many products. These properties include insensitivity to moisture, resistance to solvent and chemical attack, wide temperature operating range, plus greater tensile strength than any other plastic film. Also, Mylar will not dry out or embrittle with age, it is pointed out.

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H. T. Brooks, Engineering Personnel Dept. 613

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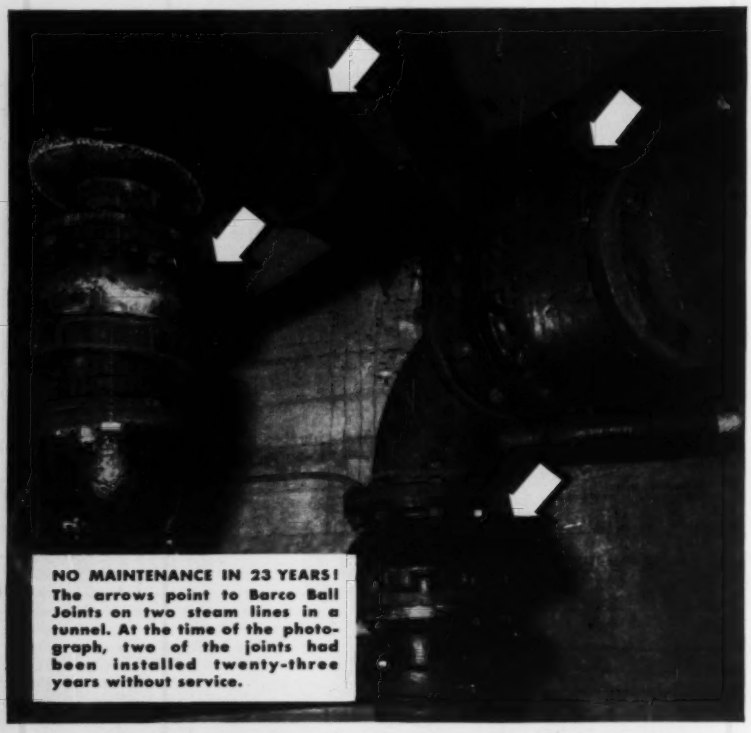
FLEXIBLE **BARCO** BALL JOINTS



NO MAINTENANCE IN 23 YEARS! The arrows point to Barco Ball Joints on two steam lines in a tunnel. At the time of the photograph, two of the joints had been installed twenty-three years without service.

How Barco Simplifies Pipe "Expansion" Problems

1. Many new applications! Every day, interesting new uses are being discovered for Barco Flexible Ball Joints in relieving *expansion* and *contraction* in piping — in Power Plants, Steel Mills, Ships, Petroleum and Chemical Processing Plants, and in Central Heating Systems.

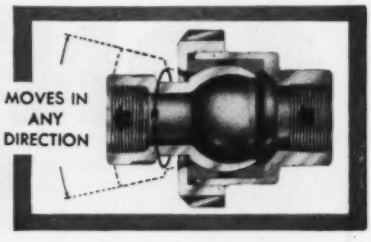
2. Tested and proved in service! Thousands of Barco Joints are now installed in steam and condensate piping. Users report complete satisfaction.

3. No heavy "pipe anchoring" required. Barco Flexible Ball Joints do not develop "end thrust" under pressure—no special provisions are necessary to tie down pipe or joints. Also, they eliminate angular strain.

4. Complete flexibility. Barco Joints do not need to be aligned for straight linear expansion—they handle lines at angles and with perpendicular take-offs with equal ease.

5. Save space! Cut costs! For installation information, ask for a copy of Engineering Drawing No. 10-50165 and new Barco Catalog No. 215B. Joints are available in a wide range of sizes; angle or straight, threaded, flange, or welding ends.

BARCO
Manufacturing Co.
521B HOUGH STREET
BARRINGTON, ILLINOIS



KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Lattice Mountings

A bulletin describing the features and applications of bonded rubber lattice mountings is now being distributed by Lord Mfg. Co., 1635 W. 12th St., Erie, Pa.

Lattice mountings are designed to solve problems of low frequency, high amplitude vibrations in heavy industrial machinery. They are produced in a variety of sizes with static deflections from $\frac{1}{4}$ to $1\frac{1}{2}$ in. and capacities from 250 to 3000 lb per mounting.

The booklet illustrates the mounting in use on a vibrating screen, foundry shakeout and heavy motor-generator. A list of the additional uses is included. A table contains complete dimension and capacity data.

Aluminum Products Brochure

The complete range of the firm's wrought aluminum mill products are presented in an eight-page brochure prepared by Harvey Aluminum, 19200 S. Western Ave., Torrance, Calif.

Illustrations and text describe extruded shapes, structurals, machining stock, drawn tube, forging stock, press forgings, impact extrusions, screw machine products, and heavy press extrusions. Included are tables pertaining to standard manufacturing limits for extrusions, standard tolerances, and properties and typical uses for various aluminum alloys.

Tank Level Measurement

Foxboro Co., Foxboro, Mass., has issued a new eight-page bulletin, No. 13–22, describing closed tank liquid level measurement and control with the recently announced Type 13 LA d/p cell liquid level transmitter.

The transmitter is essentially the same as the force balance differential pressure flow transmitter, except that a simple range suppressor spring has been added to the basic mechanism. The spring balances out the effect of hydrostatic pressure in the piping line from the high point of the tank. Transmitter is fully adjustable for measurements up to the equivalent of 250 in. of water without change of parts.

Nonmetallic Impellers

A report on recent findings with respect to the physical and chemical characteristics of nonmetallic impellers for displacement pumps is set forth in a new four-page folder available from Eco Engineering Co., 12 New York Ave., Newark, N. J.

Synthetic elastomers, fluorocarbons and resinous laminates are surveyed and the influences on them of chemicals, mechanical and thermal stresses and other operational factors, are reviewed. A page is reserved to illustrating and describing several industrial applications of positive displacement pumps which are using nonmetallic impellers suited to particular chemical handling problems, and to showing how a Neoprene and Hypalon impeller for corrosive aqueous solutions, is manufactured.

KEEP INFORMED

NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

Hydraulic Horsepower

Char-Lynn Co., Minneapolis, Minn., manufacturers of hydraulic equipment, has a new catalog which explains the basic purposes of hydraulic horsepower, and contains a chart showing the component parts needed for the producing and control of hydraulic power.

The catalog also devotes two pages to graphs which explain load capacity, cylinder speeds, volume per stroke, plumbing size necessary for certain oil volume, horsepower required for given delivery, pump size needed to deliver a known volume.

PVC Pipe Fittings, Flanges

Unplasticized polyvinyl chloride pipe fittings and flanges are the subject of a new booklet issued by Tube Turns Plastics, Inc., 2929 Magazine St., Louisville 11, Ky. It discusses industrial applications of pvc piping and gives complete specifications for threaded and socket types of fittings and flanges in both normal and high impact grades.

The booklet also lists industries that are using pvc piping and includes installation information, pressure-temperature charts, chemical resistance tables, and other helpful reference data.

Steam Piping

Pittsburgh Piping and Equipment Co., 158 49th St., Pittsburgh, Pa., announces a 20-page booklet, "Harnessing the Energy of Steam," which illustrates and describes the company's facilities for fabricating piping for central stations, pulp and paper mills, metal production, chemical plants, atomic energy and refineries.

Sections of the booklet deal with the firm's manufacturing, laboratory, engineering and testing facilities.

Coupling Bulletin

A new bulletin, No. 240, on their new quick-connect, quick-disconnect "H" coupling is now available from Snap-Tite, Inc., Union City, Pa. This bulletin describes the "H" coupling, its uses and construction, with particular reference to the exclusive U-packer which gives positive seal without compression set because of rubber distortion. To aid engineers, a fully detailed cutaway of the coupling is incorporated into the bulletin. Complete dimensions of all "H" coupling parts, as well as ordering information for spare parts and complete couplings, are also listed.

Remote Valve Control

Stow Mfg. Co., 443 State St., Binghamton, N.Y., offers a 16-page design manual on flexible shafting for the remote control of valves.

The booklet points out that by using flexible shafting, inaccessible valves up to and including valves with 27-in. diam handwheels may be controlled. Also, it is pointed out, many valves in a plant may be controlled from one central station. A chart is given for the selection of the correct size shaft for any valve. Different types of end connections are detailed.

Carbon Steel Welding

Linde Air Products Co., 30 E. 42nd St., New York 17, N.Y. has published a four-page folder illustrating and describing its Oxweld welding wires.

Oxweld No. 65 is a specially developed low-carbon wire containing three additional deoxidizing agents designed to make code quality welds in all types of carbon steel. No. 66 contains a special deoxidant that gives fine-grain welds of code quality in Group 1, Group 2 and some of the Group 3 steels.

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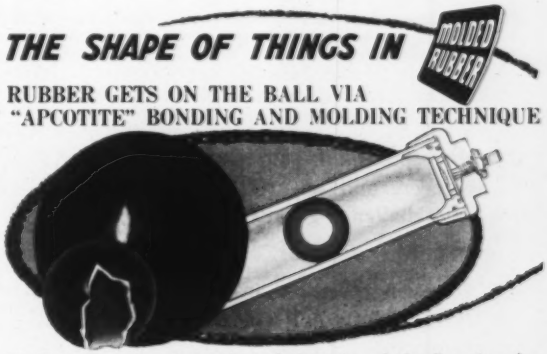


The ball shown here is a spherical piston in a hydraulic accumulator of revolutionary design. A problem faced by the manufacturer was the pressure within the cylinder causing the rubber on the sphere to flow and pull away from the aluminum surface of the ball. Acushnet was asked to produce a better bond and covering.

Using a preform mold prior to curing and eliminating pins or location rods to hold the ball was the first step in getting around this problem. Final curing of the rubber covering included the use of "APCOTITE" rubber-to-metal bond. Result was a layer of rubber ⅛" thick, concentrically perfect, bonded to the aluminum insert.

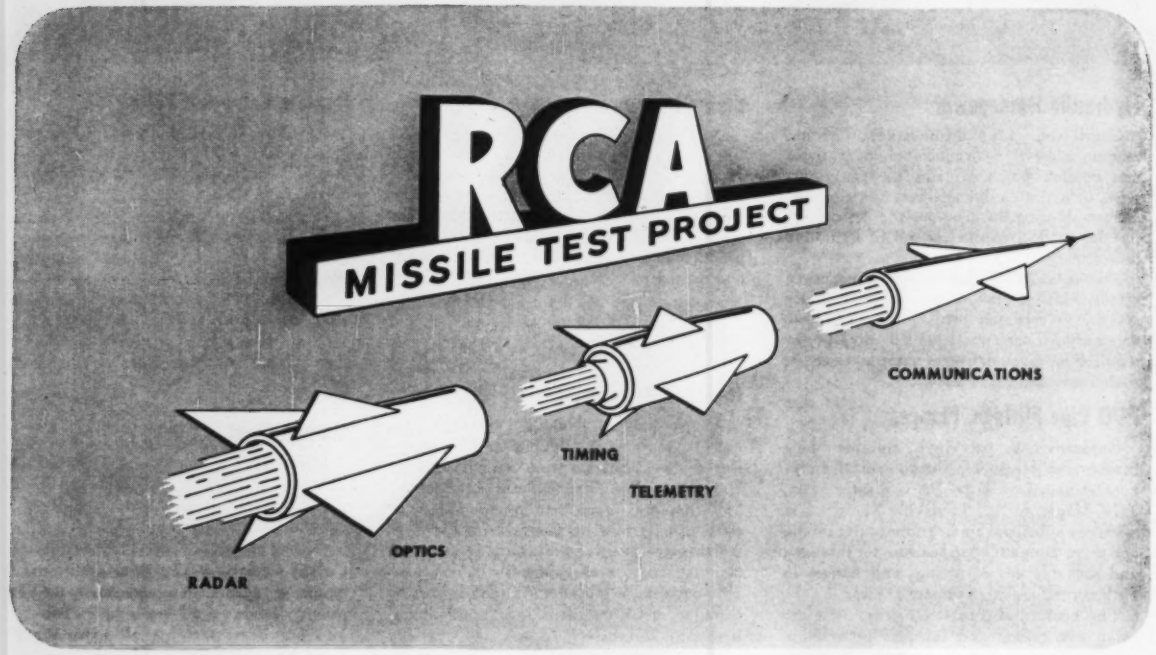
"APCOTITE" bonding to metal is exclusive with Acushnet and provides for high strength bond of rubber, synthetic polymers, silicone and plastics to all metals for the life of the part. Send for informative brochure.

Specify "APCOTITE"!

Acushnet ACUSHNET PROCESS COMPANY
NEW BEDFORD, MASSACHUSETTS

... *Precision Molded* RUBBER, SILICONES - "APCOTITE" BONDING
Address all communications to 752A Belleville Ave., New Bedford, Mass.

Opto-Mechanical Engineers and Scientists...



There's Great Opportunity for Missile Testing Instrumentation at the World's Largest Missile Testing Laboratory and Range on Florida's East Coast!

The Air Force Missile Test Center stretches from Patrick Air Force Base on Florida's central east coast to the mid-south Atlantic. RCA has full responsibility for instrumentation. And for engineers and scientists who look to a future that's challenging... RCA offers creative positions in ballistic and space-tracking techniques.

Interesting positions in stimulating projects are open *now* for you if you qualify with a Bachelor or Advanced Degree. Experience in electronics instrumentation is desired.

ENGINEERING LEADERS—to direct specialized engineering activities in design and analysis of optical tracking systems and techniques.

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TODAY . . . get complete information on arrangements for a personal interview. Send a complete resume of your education and experience to:

Mr. H. N. Ashby, Technical Employment
Missile Test Project, Dept. N-6A
RCA Service Company, Inc.
P.O. Box 1226, Melbourne, Florida

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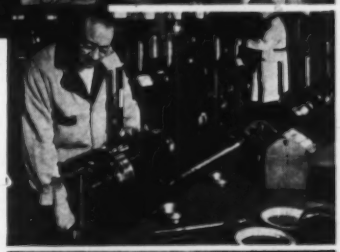
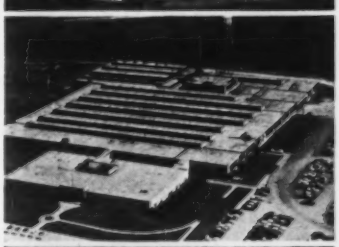
Here's how C/R COOPERATIVE RESEARCH *can help you*





HELP YOU ENGINEER YOUR PRODUCT, ELIMINATE TOUGH TROUBLE SPOTS AND SAVE YOU MONEY IN FLUID SEALING AND RELATED FIELDS

Developing a new product or rectifying trouble in a present one? Why not supplement your own engineering facilities with C/R Cooperative Research? In the areas related to oil seal design, lubricant, chemical, gas, or air retention, and foreign matter exclusion—as well as in the development of synthetic rubber and impregnated mechanical leather parts—Chicago Rawhide's developmental facilities are the most extensive in the country.

All of them are at your service . . . for help with your critical or unusual problems. You may be sure that your design specifications, performance requirements, and production controls will be met to the letter. A few of the many ways in which C/R Cooperative Research serves other leading manufacturers are pointed out on this page. We'll be glad to help you.

INFORMATION . . . Comprehensive brochures and catalogs are available to give you the complete scope of C/R products and services. Write for your copies, and please indicate your area of interest.

DESIGN . . . When your product is on the drawing board is the time to correlate design and materials with performance requirements. C/R's expertly-staffed engineering groups working in close cooperation with the material labs have done it for others . . . and can do it for you.

MATERIALS . . . Pioneers in the development of Sirvis (mechanical leather) and Sirvene (synthetic rubber) parts for oil seals and other mechanical applications, C/R will custom-develop materials for your special needs in our synthetic rubber or leather laboratories.

PRODUCT TESTING . . . Many products, new and present, need extensive checking. C/R testing labs often work many months to verify designs, eliminate trouble. This is standard procedure on all C/R stock products . . . essential in developing yours.

TROUBLE SHOOTING . . . Auto and heavy equipment makers, as well as manufacturers in most fields you can think of, have solved difficult sealing and related problems with the help of C/R Cooperative Research. You can, too . . . and save time, trouble and money.

PRODUCTION . . . Six plants, operating as extensions of C/R Cooperative Research, provide laboratory-like quality control, timed to your needs. C/R Sales Engineering follows through to coordinate and assure satisfaction.

EXPERIENCE . . . Broadest in the field. Proof? More automobiles, farm equipment and industrial machines rely on C/R Oil Seals than on any similar sealing device. C/R diaphragms, boots and gaskets are in the same top categories.

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Curtiss-Wright Corporation's rapid growth in commercial fields has created excellent positions for men of specialized ability. Expansion of the Research Division has called for the establishment of an 85-square-mile Research and Development Center at Quehanna, Pennsylvania.

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Curtiss-Wright also has numerous openings for engineering graduates not as yet qualified for these more advanced positions. Personnel benefits are many, and the company's research activities cover such products and projects as:

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New Research and Development Center providing the latest facilities for the advancement of gas turbine, ram jet, nuclear, rocket powerplants and for Curtiss-Wright's many diversified areas of research including electronics and ultrasonics.

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Nuclear Power

Research into those aspects of nuclear physics, chemistry, electronics, radiation damage, heat transfer, fluid flow, metallurgy, new materials and processes which enter into the design of reactors and nuclear powerplants for the Government.

Electronics

Research on equipment having automatic controls, reactor control instruments and systems, radiation measuring and detection devices and similar equipment for industry.

Ultrasonics

Research on applications of ultra high frequency sound to food processing, materials inspection, parts cleaning, metal drilling and other industrial uses.

Designers and Development Engineers . . . to work on extremely lightweight rotating machinery; coordinate with other specialists engaged in related projects.

Metallurgists . . . for high stress, high temperature machinery. Cooperate closely with designers, shop and development personnel. Advise on materials and special fabrication methods in design stage. Interpret and remedy failures in experimental stage. Direct juniors and technicians in materials testing, welding, brazing, high-temperature alloy development, powder metallurgy.

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Nuclear Materials Scientists . . . to study basic properties of unusual materials, alloys, crystal structures, phase diagrams, radiation damage, corrosion, bonding problems, etc.

Nuclear Heat Transfer Engineers and Physicists . . . to assist in the design, analysis, and experimental work involved in developing heat transfer and fluid mechanics systems.

Theoretical Physicists . . . Conduct analysis and advanced design concept work for nuclear reactors, shielding and nuclear power systems.

Controls Engineers . . . for the design or development of aircraft engine and reactor controls. Capable of applying theory using electrical analogs; have practical experience in actual working of systems.

Advanced Compressor Engineers . . . for the aerodynamic development of transonic and supersonic compressors. Others, experienced in supersonic wind tunnel work and cascade blade design and research.

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Vibration Engineers . . . experienced in the use of current instrumentation to analyze vibration characteristics of complex rotating and stationary parts.

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Nuclear Engineers . . . Mechanical, Chemical, Electrical, Sanitary, Industrial, Aeronautical, others to join a strong nucleus of engineers and scientists in the research and development of nuclear powerplants. Some experience in the nuclear field required.

Nuclear Manufacturing Engineers . . . Experienced in fabrication and manufacturing fields associated with nuclear reactor and atomic energy. Knowledge required: handling unusual materials, brazing, welding, forming, toxicity problems, accountability procedures.

Ceramics Engineers . . . with practical experience in the design and experimental development of new materials for a variety of applications.

For appointment for interview

Personal, confidential interviews will be arranged upon receipt of typewritten resumes, giving complete details of education and past experience.

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CURTISS-WRIGHT

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Look to These Important 1955 Safety Codes

for up-to-date information with respect to
the design features, construction, maintenance, and operation of

Elevators

Pressure Piping

Plumbing Systems

Industrial Trucks

Safety Code for Elevators, Dumbwaiters, and Escalators, A17.1—1955 $3.50

Here in twelve parts and 104 sections are rules for the construction of power passenger and freight elevators and dumbwaiters, hydraulic elevators, power and hand sidewalk elevators, private residence elevators and inclined lifts, hand elevators, hand and power dumbwaiters, and escalators. Here too, are rules for the construction of hoistways, hoistway enclosures; the provisions for car safety devices, car and counterweight safeties; guide rails and fastenings, other machinery and equipment, supports and foundations; in addition to recommendations for inspection, tests, maintenance, alterations, repairs, and replacements.

Fourteen subcommittees with a total membership of 150 formulated this 1955 Code in the light of experience derived from the adoption and enforcement of the previous edition and developments in the design of elevator equipment.

Safety Code for Industrial Power Trucks, B56.1—1955 $1.00

This Code promotes safety of personnel and equipment by establishing uniform fundamentals of certain elements of design, by setting up rules for operation and maintenance of industrial trucks including those powered by gasoline engines, gas engine generating equipment, and storage batteries, and by supplying truck operators with 35 safety rules applying to traffic, motor and fuels, repair, loading, and operation.

Code regulations apply to both the driver-ride and driver-lead types such as platform trucks, tractors, low- and high-lift trucks, fork trucks, in fact almost all types of powered trucks not intended for highway operation.

National Plumbing Code, A40.8—1955 $3.50

This code gives the correct engineering provisions for safeguarding the water supply to homes, factories and apartment houses, for the fixtures to be installed, and for the removal of liquid waste from buildings. Additionally, it presents administrative data for law enforcement agencies, provides standards for sanitary installation within a trailer coach, and offers a set of standards for trailer park sanitary facilities. Requirements are set forth as follows:

Chapters 1—Definitions; 2—General Regulations; 3—Quality and Weight; 4—Joints and Connections; 5—Traps and Cleanouts; 6—Interceptors, Separators and Backwater Valves; 7—Plumbing Fixtures; 8—Hangers and Supports; 9—Indirect Waste Piping and Special Wastes; 10—Water Supply and Distribution; 11—Drainage System; 12—Vents and Venting; 13—Storm Drains; 14—Inspection, Tests and Maintenance. Appendices: A—Individual Water Supply; B—Individual Sewage-Disposal System; C—Air Gaps, Backwater Preventers and Drinking Fountain Standards; D—Sizing of Water Supply; E—Administrative Data; T—Trailer Coach and Trailer Park Standards.

Code for Pressure Piping, B31.1—1955 $3.50

This latest edition will be found invaluable when selecting materials, choosing dimensions, designing parts and assembled units, erecting piping systems, testing elements before erection, and testing completed systems after erection.

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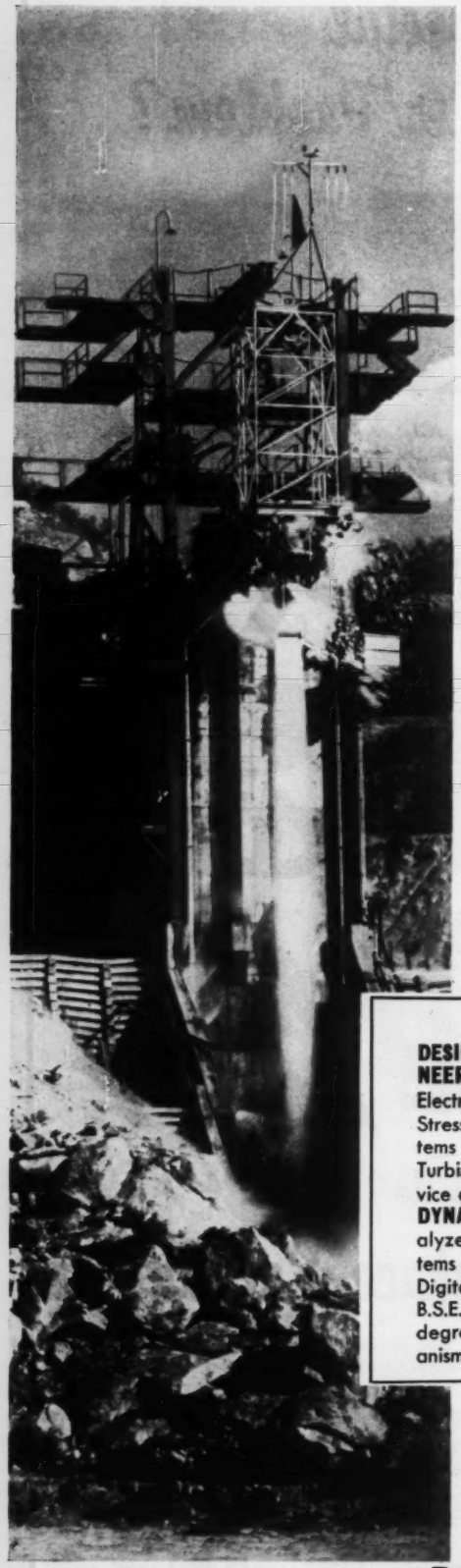

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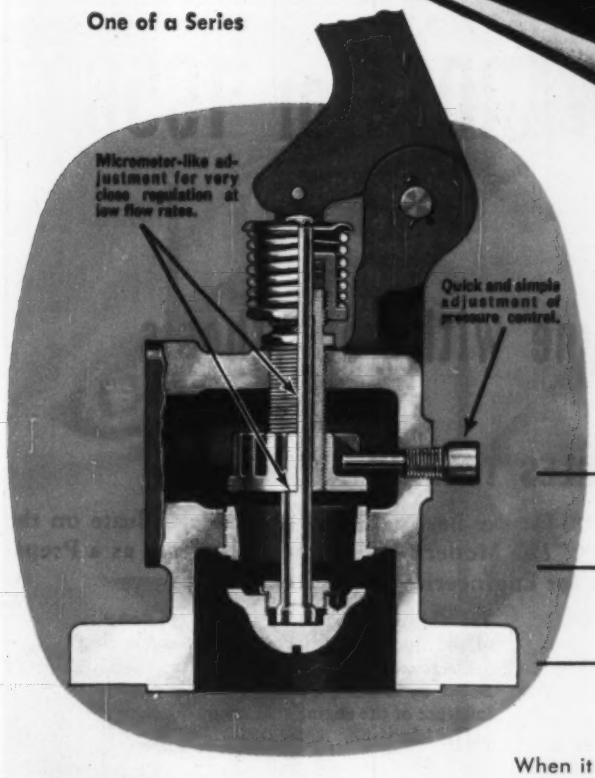
Micrometer-like adjustment for very close regulation at low flow rates.
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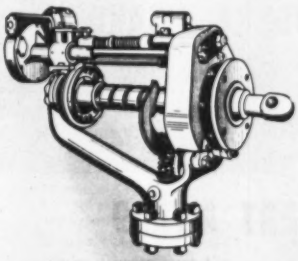

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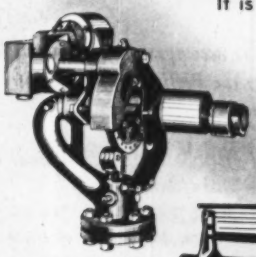

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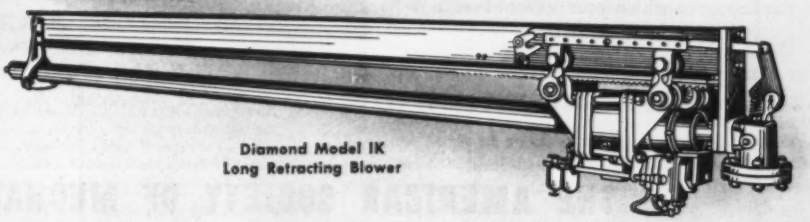

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BOMARC, as well as other "years ahead" Boeing projects, which cannot be discussed here, are complex challenges to the utmost skill of a mechanical engineer. He will find real creative interest in rocket, ram-jet and nuclear power research, investigating the problems of heat, compressibility, elasticity and "creep," and other fields. "M.E.'s" also do vital work in structural and flight testing, stress analysis, thermo and fluid dynamics.

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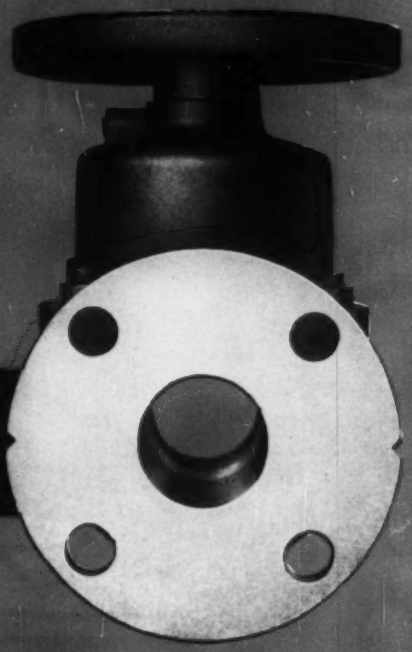
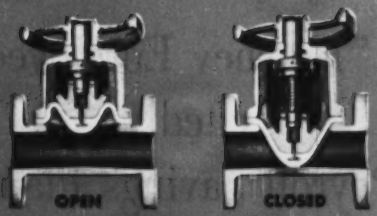


...the diaphragm valve with STRAIGHT-THROUGH FLOW, for handling viscous materials, fibrous slurries, sludges, pulp stock, latex, magmas, semi-fluid foods, solids in suspension, sewage, water, corrosive chemicals



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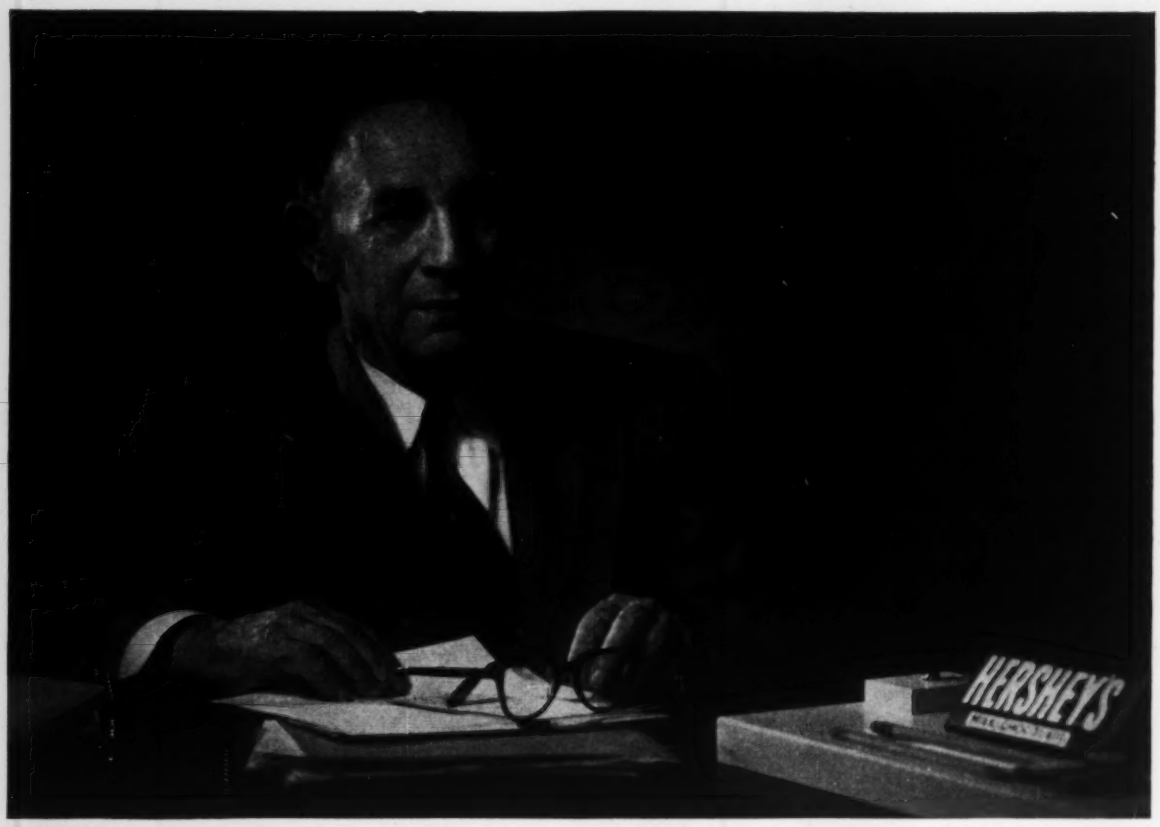

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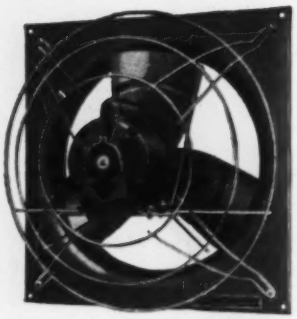

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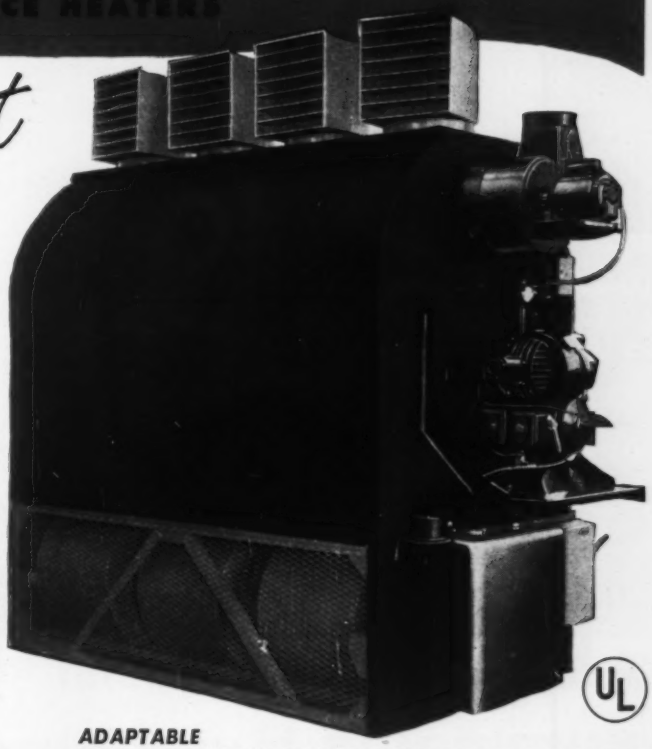

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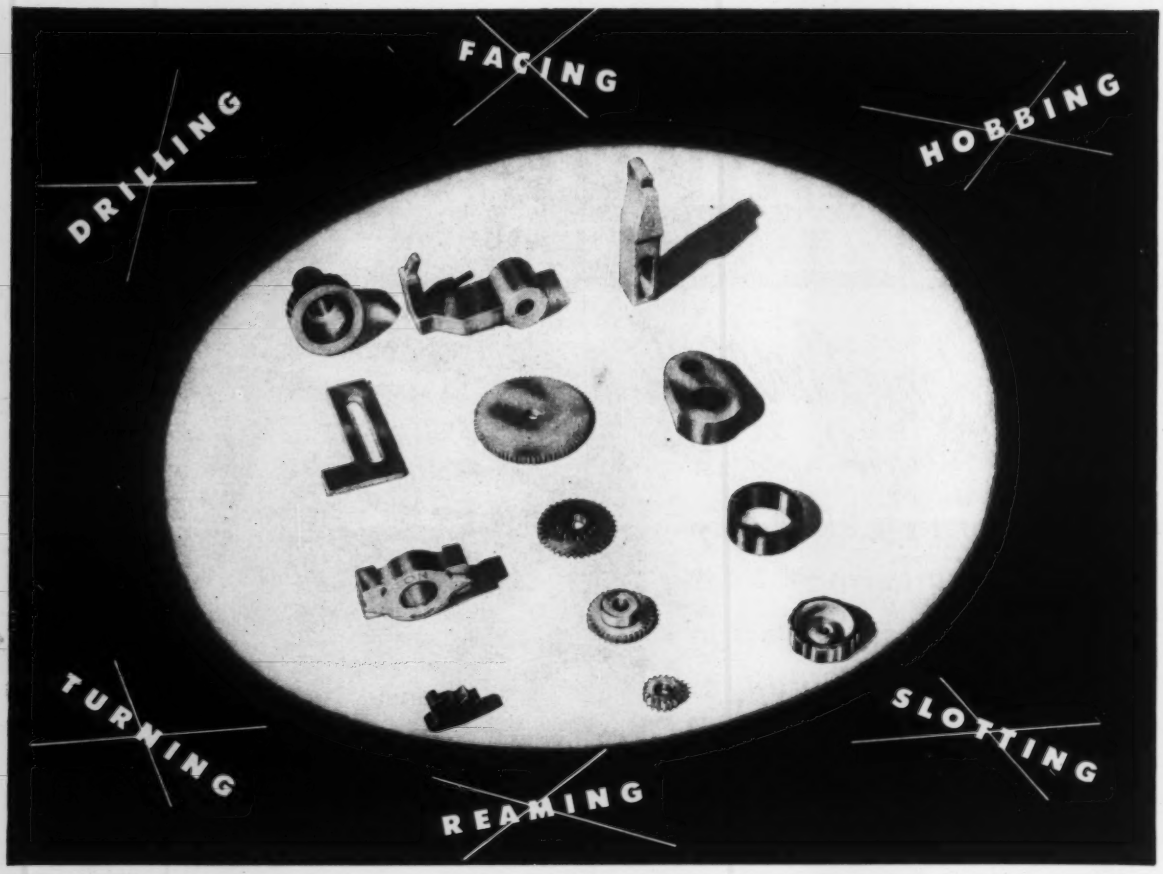

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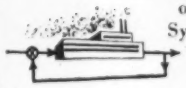

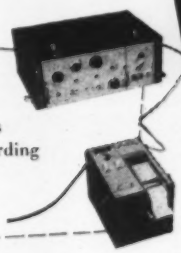

Sanborn Single-Channel System

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of valves when equipped with a certain pneumatic Valve Positioner is determined by the manufacturer with a Sanborn Two-Channel System and Sanborn Carrier Amplifiers.

Sanborn Two-Channel System

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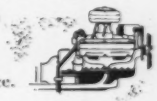
are recorded simultaneously by an oil company in their study of fuels and lubricants as they relate to engine performance.

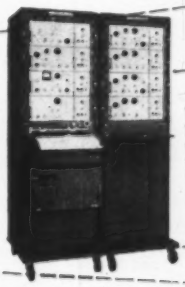


DRONE MISSILE
manufacturer can simulate the flight of the missile and derive information concerning its behavior under certain conditions by means of an analog computer and a Sanborn Four-Channel System with four Sanborn AC-DC Preamplifiers.

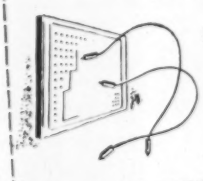
Sanborn Four-Channel System

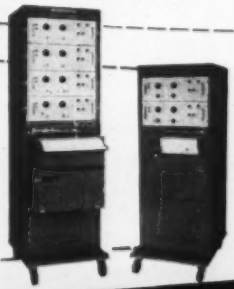
ATOMIC REACTOR
to be used for power generation in prototype plant is studied with the help of a Sanborn Eight-Channel System which records the output of thermo-couples, strain gage pressure pickups, and resistance devices.

Sanborn Eight-Channel System



ANALOG COMPUTING
center uses Sanborn Eight-Channel Systems to record the solutions of problems having six or eight variables. Sanborn systems specially designed for this type of work utilize Dual-Channel DC Amplifiers.





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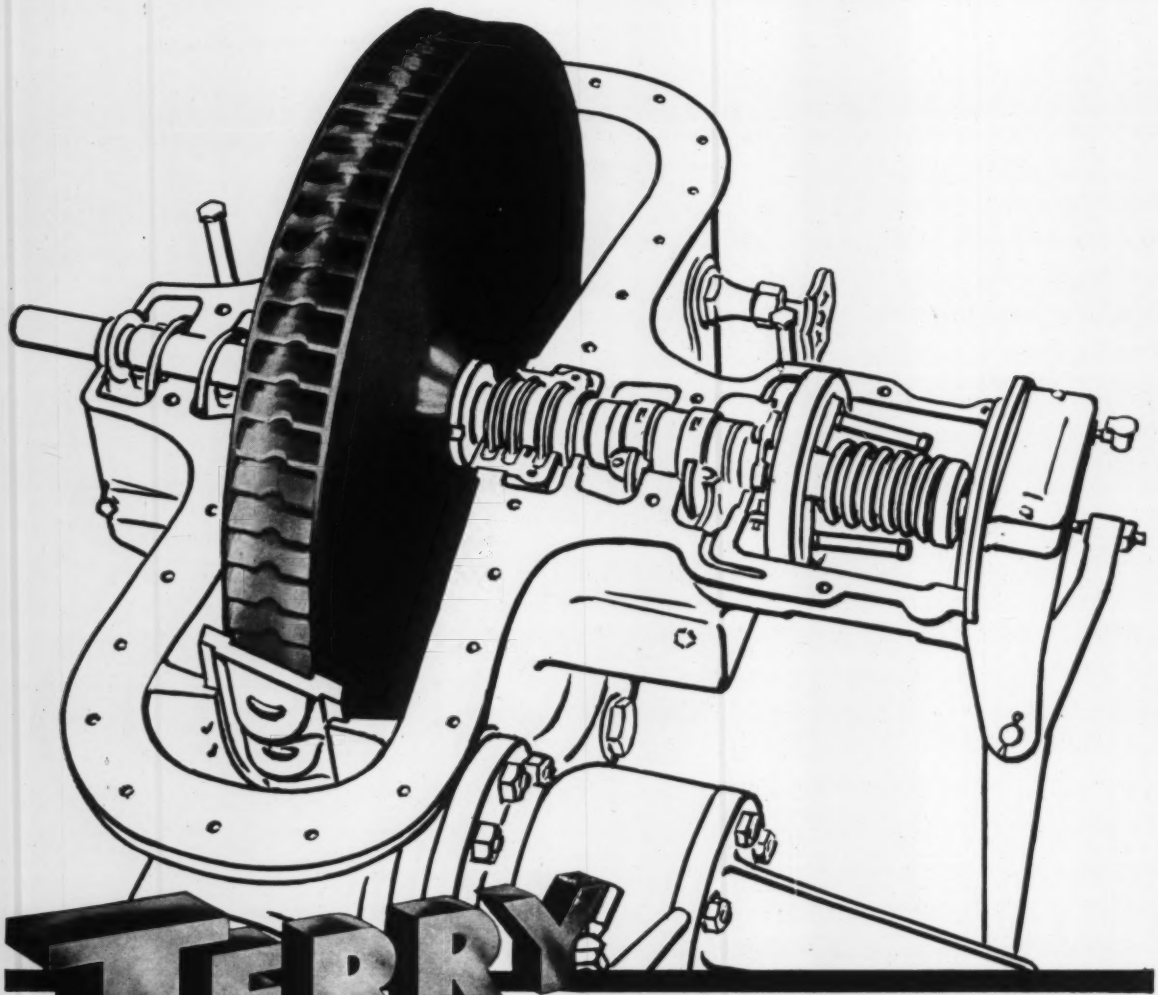
CAMBRIDGE 39, MASSACHUSETTS



SOLID WHEEL RUGGEDNESS

is your turbine dividend

The rugged construction and fool-proof design of a Terry solid-wheel turbine can save you money by keeping maintenance costs to a minimum. Usually only taken down for routine inspection, any repairs that must be made are of relatively simple nature, and cost of replacement parts is small.

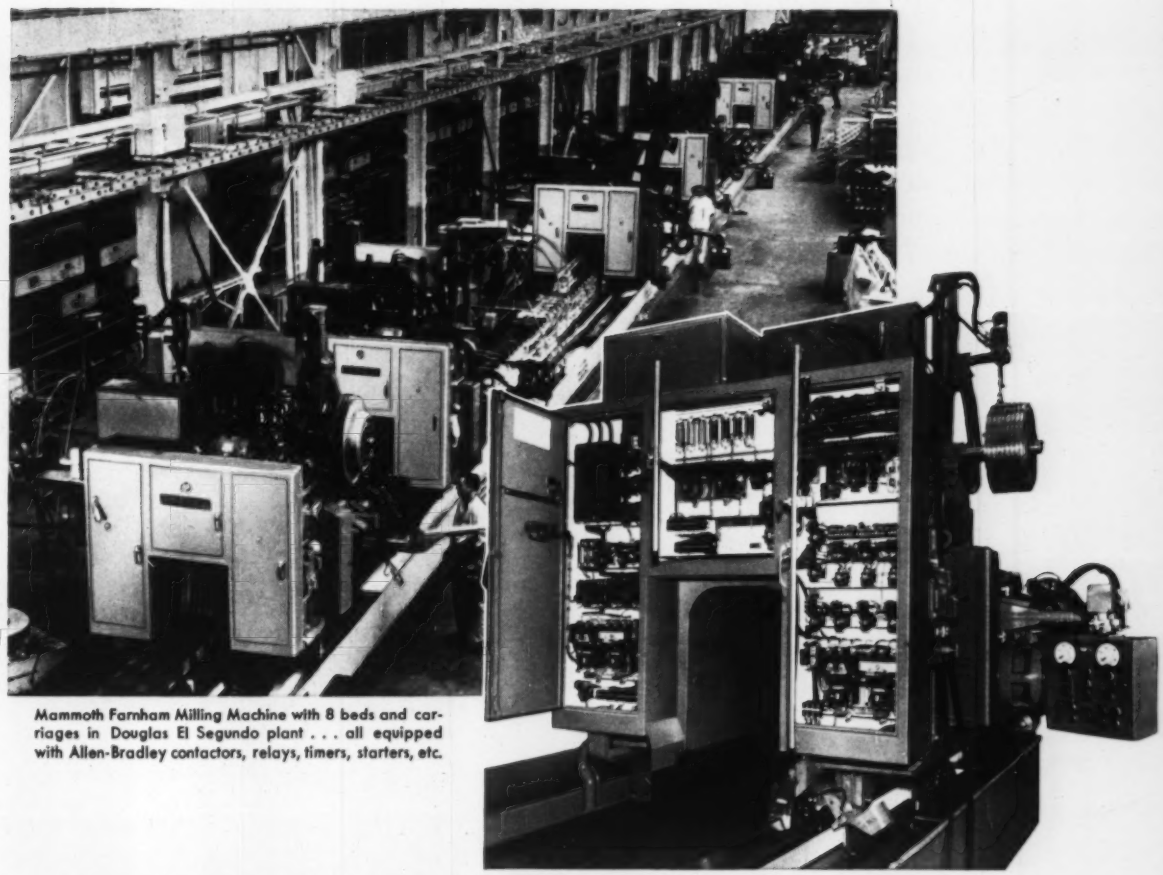
The rotor of the turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to loosen or work out. As the only function of the blades is to form a series of pockets, any wear which might occur would not materially affect horsepower or efficiency.

It is impossible for the blades to foul. They have large clearances and are further protected by the projecting rims of the sides of the wheel. As the side clearances are also very large, end play can do no harm.

The Terry solid-wheel turbine is an extremely reliable piece of equipment—why not write for complete details today? Ask for a copy of Bulletin S-116.

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONN.

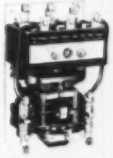
TT-1198



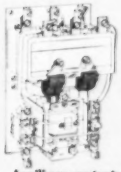
Mammoth Farnham Milling Machine with 8 beds and carriages in Douglas El Segundo plant . . . all equipped with Allen-Bradley contactors, relays, timers, starters, etc.

308 FOOT MILLING MACHINE
. . . operated by Allen-Bradley Motor Controls

Solenoid starter Size 1



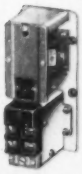
Solenoid starter Size 3



Auxiliary contacts on starter hood

Oiltight potentiometer control

Pendent push button control



Pneumatic automatic timer

Universal 4-pole relay

Oiltight push button. NO & NC contacts

Interlocking terminal blocks

Oiltight limit switch—all types

When the Farnham Manufacturing Division of The Wiesner-Rapp Co., of Buffalo, N.Y. built this impressive, 308 foot milling machine, they used Allen-Bradley control components for all 8 carriages. Thus, they assured themselves and Douglas of utmost reliability for this complex machine tool.

If you manufacture motor-driven machines, don't overlook the fact that Allen-Bradley motor controls are a big sales asset to any machine. The A-B trademark is a guarantee of trouble free performance . . . and is so recognized by machine tool buyers. Did you notice how much in evidence this trademark was at the Chicago Machine Tool Show?

Send for the Allen-Bradley Handy Catalog. It is a valuable handbook on modern motor control. Write today.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

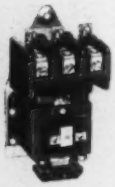
A-B Quality

ALLEN-BRADLEY QUALITY

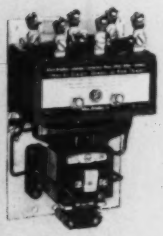
SPECIAL PANELS

ALLEN-BRADLEY
A-C CONTACTORS

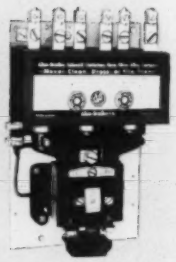
2 pole—Size 00
10 ampere



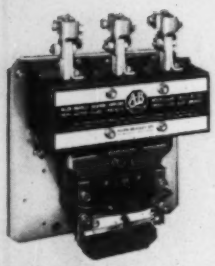
3 pole—Size 1
25 ampere



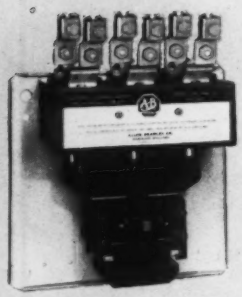
3 pole—Size 2
50 ampere



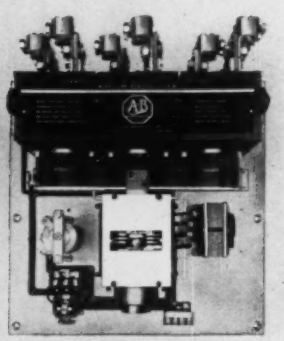
3 pole—Size 3
100 ampere



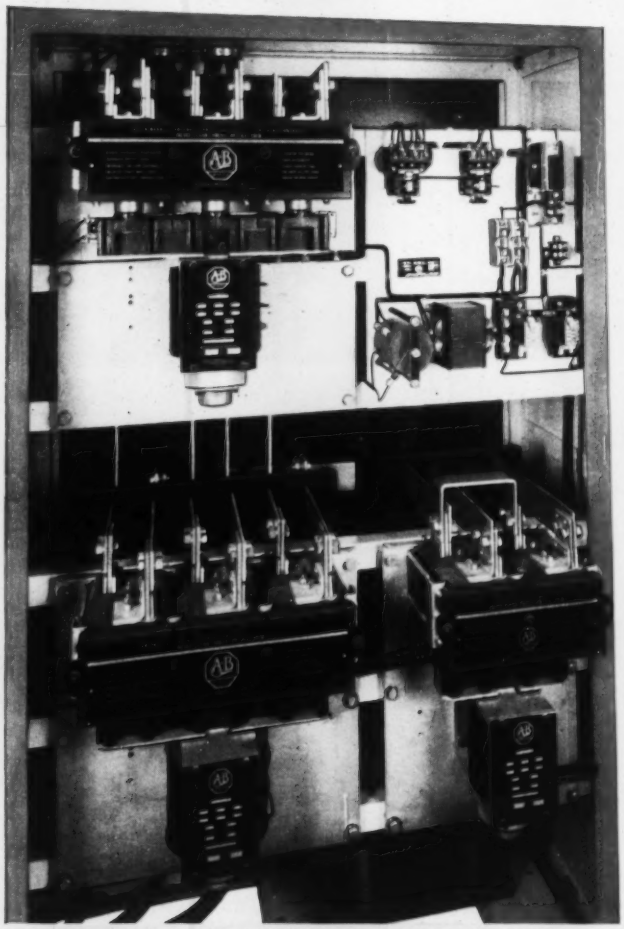
3 pole—Size 4
150 ampere



3 pole—Size 5
300 ampere



3 pole—Sizes 6 & 7
600 & 900 ampere contactors



250 Hp, Bulletin 746 automatic autotransformer showing Allen-Bradley Size 7 contactors

A-C and D-C CONTACTORS

10 to 900 Amperes

with Double Break, Silver Alloy Contacts

The only complete line of solenoid contactors on the market. Allen-Bradley offers nine sizes...from Size 00 (10 amperes) to Size 7 (900 amperes), one to four poles.

There is no contact maintenance . . . no pins, pivots, or bearings to give trouble. Just one moving part—the simple solenoid plunger. Operating characteristics are consistent for all nine sizes.

Enclosures can be supplied for general purpose, water-tight, dust-tight, and explosion-proof service.

Allen-Bradley controls are an added sales asset to any machine. May we send you our catalog?

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

A-B Quality

ALLEN-BRADLEY
SOLENOID CONTACTORS
QUALITY

1-54-A1

Put Two More Draftsmen In Space Now Occupied by Four!

Yet Give Each Man More Efficient, Comfortable Working Room . . .

with Hamilton Auto-Shift Tables — from Bruning!

Save Space — Get 30% More Use from Present Area. The same floor space (about 250 square feet) taken up by *four* boards with separate reference desks will easily accommodate six Auto-Shifts. Auto-Shift combines a board and reference desk in one compact unit. The draftsman uses the board of one table while utilizing the large reference surface and drawers of the table behind him. This dual utility saves you space for other advantageous use or lets you put more draftsmen to work in your present space.

Eliminate Waste Motion — Save Man Hours. Auto-Shift eliminates needless detours for reference material and supplies. The draftsman merely turns on his stool and pulls forward the reference surface of the Auto-Shift Table behind him, or reaches into one of its conveniently located drawers for whatever materials and tools he needs.

Reduce Draftsman Fatigue — Boost Productivity. Auto-Shift provides fast, easy board adjustment—lets the draftsman change working position often for greater comfort and efficiency. Convenient foot release frees top for height adjustment. Hand release permits quick, easy slope adjustment—slight fingertip pressure sets counterbalanced top at any desired angle. Draftsman can reach any part of the board without strain whether seated or standing.

Mail coupon below for detailed information on the important savings offered you by Auto-Shift.

Only Auto-Shift Offers You These 3 Big Advantages!

1. Only Auto-Shift offers instantaneous, positive adjustment of slope.
2. Only Auto-Shift provides instantaneous height adjustment, lets draftsman switch standing or sitting positions, quickly and easily.
3. Only Auto-Shift lets draftsman work on any part of the board without leaving his seat.

Ask your Bruning representative for information about the Bruning-Hamilton free analysis and planning service for improving your drafting operation — or use coupon at right. No obligation.

BRUNING

America's Leading Supplier of Engineering and Drafting Equipment

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4700 Montrose Avenue Chicago 41, Illinois Dept. 14-N

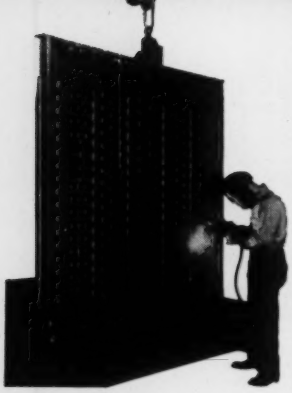
☐ Please send me information on Hamilton Auto-Shift Tables.
☐ Send me information on the Bruning-Hamilton free analysis and planning service.

Name_____ **Title**_____

Company_____

Address_____

City_____ **County**_____ **State**_____



WELDING SOLVES ANOTHER

and USS "T-1" Steel solves the welding problem!

Bedplates for modern color-printing presses have to be rugged—but as lightweight as possible. They must withstand constant pounding from printing rollers and cutting knives. And, since they move back and forth continually, they've got to be lightweight for fast, efficient operation. It is a good place to use a welded assembly of steel plates.

But that's where Graver Tank & Manufacturing Co., Inc., ran head-on into a tough fabrication problem. Alloy steel with the necessary strength and durability was difficult to weld. And with 534 welds on *every* bedplate, this was a king-size headache.

NO MORE HEADACHE!

Now the headache is gone. Production costs are down. And the finished bedplates are working hard and long . . . taking a tremendous daily pounding without distortion.

The solution? Just a switch to a remarkable *new* alloy steel, USS "T-1" Steel.

"T-1" Steel is very strong. Very tough. Able to take vicious impact abuse. Yet, it's easy to weld, "says Mr. H. McDonald, Superintendent at Graver."

HOW ABOUT YOU?

If you have tough jobs, rugged jobs, where you want to weld your way to lower costs, give this new steel a try. We think you, like Mr. McDonald, will find it the best thing you have ever used. Right now, "T-1" is in service and doing well in bridges, power shovels, steam turbines, electrical transformer tanks, flywheels, pressure vessels, mine cars, and lots of other places. Write for details. United States Steel, Room 5090, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

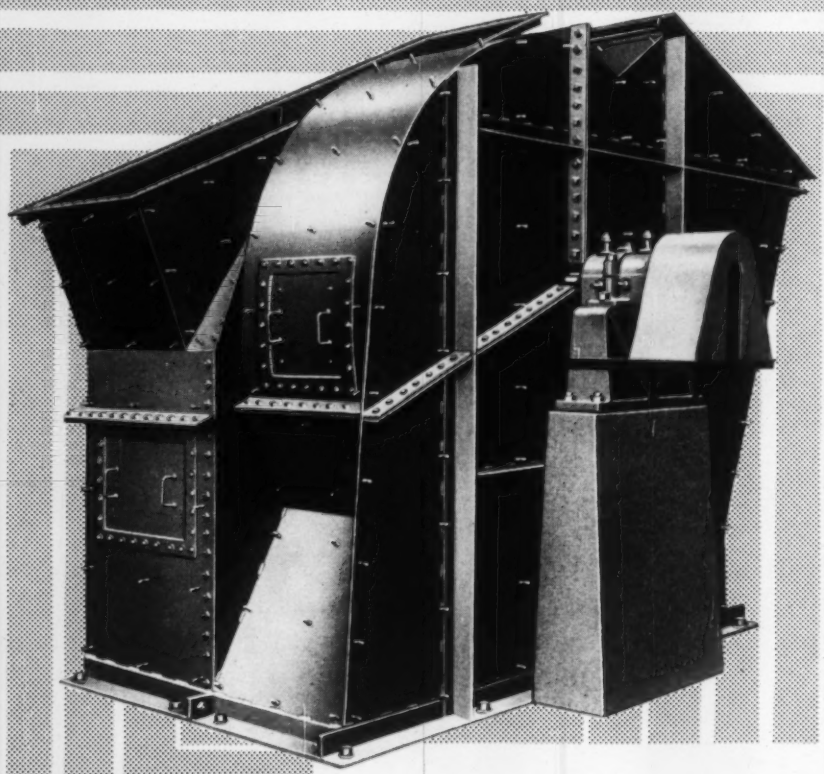
"TOP QUALITY!" That's how Graver Tank & Manufacturing Co., Inc., East Chicago, Indiana, describes new USS "T-1" Steel. It gives them a yield strength of 90,000 psi . . . exceptional resistance to impact abuse . . . and good weldability. It enables them to build extremely rugged, all-welded bedplates for printing presses.

WEIGHT PROBLEM

USS "T" CONSTRUCTIONAL ALLOY STEEL

UNITED STATES STEEL

Over 3000 power plants are Clarage equipped



With mechanical draft fans especially, first cost is not the major consideration. Economy is measured by your investment over the long pull.

That's why Clarage fans enjoy such a high standing in power production. Here's equipment designed and constructed to take punishment in stride. Wheels, shafts, housings, bearings — all are built **above and beyond** the demands of average service.

You can install Clarage equipment with confidence that operating and maintenance costs will be at an absolute minimum. Hundreds of Clarage fans in continuous service for 30 years and longer testify to that!

Have us put the facts in your hands. Request catalogs on Clarage Type RT induced and forced draft fans . . . Type W, Classes III and IV forced draft fans . . . Type NH, Class II-A forced draft fans. **CLARAGE FAN COMPANY, Kalamazoo, Michigan.**

YOU CAN RELY ON **CLARAGE**

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

New Alcoa book tells how, where, why to use Aluminum Pipe and Fittings

ALCOA Aluminum Pipe is being used in more applications—solving more and more problems than ever before. That's because ALCOA Aluminum Pipe offers three important advantages: (1) Its low price makes it the least expensive material to use for special-purpose piping; (2) Its lightness makes it ideally suited for quick, economical installation; (3) Its durability keeps maintenance and replacement costs at rock bottom.

The complete story is in this new ALCOA book. Filled with useful illustrations and charts, it gives all the facts on the latest uses of ALCOA Aluminum Pipe and Fittings for:

PROCESS PIPING APPLICATIONS for carrying fluids in chemical and petroleum plants, food processing plants, and many others.

PIPELINE APPLICATIONS for carrying oil and gas; for mine drainage and similar applications.

PORTABLE PIPING APPLICATIONS for supply or disposal lines that handle water, steam, compressed air, fuel and other commodities in such operations as construction, oil well drilling and mining.

STRUCTURAL PIPING APPLICATIONS for use as railings, fence posts, playground equipment, storage racks and scaffolds, and other outdoor uses.

All this plus detailed information on fittings and flanges, valves, installation procedures, and eight helpful tables to aid you in selecting the *right* ALCOA Aluminum Pipe for your need.

Write today for your free copy. Use the coupon.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA
*ALCOA

Aluminum Company of America
908-A Alcoa Building
Pittsburgh 19, Pennsylvania

Please send me your new, FREE booklet, *Aluminum Pipe and Fittings*.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

For Controlled Feeding of Bulk Materials

SYNTRON VIBRATORY FEEDERS

Especially adaptable for use in automatic weighing and packaging machines, bag and drum filling and weighing, and automatic batch weighing systems.

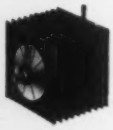
Provide low cost efficient feeding of bulk materials. Electromagnetic drive eliminates motors, belts, gears and eccentrics. Maximum capacities from 500 lbs. to 750 tons per hour. Feed rate easily regulated—merely by turning a control dial in the separate controller.

Other Cost-Reducing Equipment

ELECTRIC VIBRATORS

For a free flow of bulk materials through bins, hoppers and chutes.

SELENIUM RECTIFIERS



Vacuum process, high quality, uniform cells Sizes 1" to 12" x 16". Extremely low forward voltage drop.

HEATING ELEMENTS

For economical, efficient immersion or contact heating. Are rapid heating—have uniform distribution, are flexible in shaping.

Write for Catalog Data

SYNTRON COMPANY
498 Lexington Avenue — Homer City, Penna.

To the engineer who likes to blaze new trails . . .

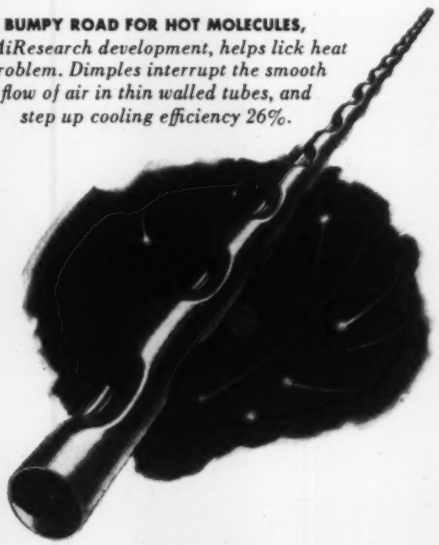
AiResearch is looking for your kind of engineer.

We are playing a vital part in the great engineering advances now taking place. Leadership in heat transfer is one example.

We also pioneered the fields of small turbomachinery and aircraft air conditioning and pressurization systems and developed many different types of pneumatic and electronic equipment . . . now manufacture more than 1000 different products.

Positions are now open for mechanical engineers . . . electrical engineers . . . physicists . . . specialists in engineering mechanics . . . specialists in aerodynamics . . . electronics engineers . . . aeronautical engineers.

BUMPY ROAD FOR HOT MOLECULES, *an AiResearch development, helps lick heat problem. Dimples interrupt the smooth flow of air in thin walled tubes, and step up cooling efficiency 26%.*



Write to Mr. Wayne Clifford, AiResearch Manufacturing Company, 9851 S. Sepulveda Blvd., Los Angeles 45, California. Indicate your preference as to location between Los Angeles and Phoenix.

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

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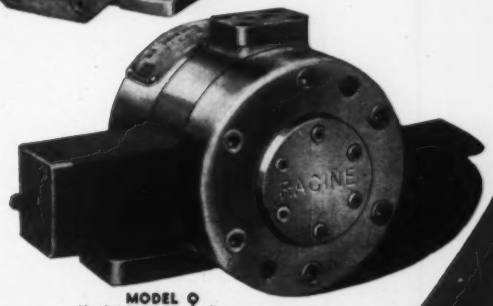
Designers and manufacturers of aircraft components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS • CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

RACINE *Variable Volume* PUMPS

"The heart of any Hydraulic Circuit"

MODEL F
Variable Volume Pump
12 - 30 G.P.M.
Pressures to 1000 p.s.i.

MODEL K
Variable Volume Pump
70 G.P.M.
Pressures to 1000 p.s.i.



MODEL Q
Variable Volume Pump
5 G.P.M.
Pressures to 1000 p.s.i.

USE RACINE PUMPS, VALVES, PRESSURE BOOSTERS AND RESERVOIR UNITS
"They Work Better Together"

SALES AND SERVICE REPRESENTATIVES IN ALL PRINCIPAL CITIES

Racine Variable Volume Pumps simplify the circuit. They reduce heat losses and save horsepower. Relief and by-pass valves with extra piping are unnecessary. Your initial circuit costs are usually lower. Write for complete catalog and name of your nearest Racine Field Office. Complete engineering service available . . . Address: RACINE HYDRAULICS & MACHINERY, INC., 2076 Albert Street, Racine, Wisconsin, U. S. A.

How much does the best BEARING METAL cost?

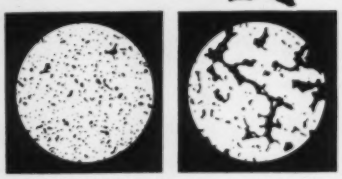
BEARIUM METAL, once it is put to work, actually costs *less* than ordinary bearing materials. The savings it effects in maintenance costs alone (preventing costly equipment breakdowns) more than offset the slight initial price differential. Proof can be found in hundreds of varied applications as testified in letters received from many satisfied users. Here are excerpts from two such letters—

"Bearium Metal is standing up very satisfactorily in our many bearing services at this plant and is superior to any other metal which we have used. We are proceeding with our long-range program of utilizing Bearium Metal to provide reduced maintenance on our machinery."

"In our experience, Bearium Metal has definite characteristics which are not attainable in other bearing bronzes. We have inadvertently obtained other high-lead bronzes and had difficulties which were not experienced when genuine Bearium Metal was used."

Names on Request

The secret of BEARIUM METAL'S superiority is due to the uniform distribution of microscopic lead particles within the copper-tin grains rather than between the grain boundaries—as illustrated by these two photomicrographs.



Bearium Metal *Ordinary leaded bronze*

BEARIUM METAL

FEATURES: Non-Seizing and Non-Scoring • Long-Wearing • Self-Lubricating • Low Coefficient of Friction • High Compressive Strength • Resistant to Shock Loads • Sound, uniform structure • Free-Cutting.

AVAILABLE IN: cored and solid bars • centerless-ground rods • machined parts • pattern castings.

Wherever there is a bearing application involving high speeds, poor lubrication, heat-generating loads, elevated temperatures, dusty and gritty surroundings—or where a liquid other than oil is used as a lubricant—there you will find the ideal application for BEARIUM METAL.

Yes, BEARIUM METAL *does* out-perform all other types of bearing materials . . . on *all* counts! Try it on one of your toughest applications and prove it to your own satisfaction!

We are at your service—WRITE TODAY!

BEARIUM METALS CORP.

193 Mill St., Rochester 14, N. Y.

WEST COAST AFFILIATE
Bearium Engineering Associates
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155 George St.
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LENAPE MANWAYS and FITTINGS

11 x 15" N Fitting.

A wide variety of access openings.

Lenape elliptical access openings (straight rings or flued and curved saddles) and nittings, of the pressure loaded or "self-energized" type are produced in sizes ranging from 4" x 6" to 18" x 24".

Typical Lenape Fittings

- 11 x 15" Type L 150 PSI in steel, Everdur, and 304 Stainless.
- 11 x 15" Type N 450 PSI for general application.
- 11 x 15" Type S 250 PSI with external split recessed clamp plate for paper machine dryers
- 12 x 16" Type N 450 PSI for general application.
- 12 x 16" Type HP 800 PSI for heavy duty.
- 14 x 18" 300 PSI Hinged for beverage tanks.
- 18 x 24" 200 PSI for large clean-outs.

Full details are found on pages 42 to 49 of Lenape Catalog 10-53.

LENAPE HYDRAULIC PRESSING AND FORGING CO.

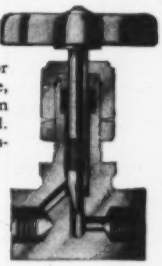
LENAPE HYDRAULIC PRESSING & FORGING CO.
DEPT. 114 WEST CHESTER, PA.
RED MAN PRODUCTS

REPUBLIC VALVES

INDUSTRIAL • CHEMICAL • AIRCRAFT

10,000 psi WORKING PRESSURE FORGED BODY

One-piece, stainless steel, forged body and stem guide, with no brazing or welding—*can't* leak or come apart. Has many uses in water, gas, oil, and vacuum service.



Proofed at 25,000 psi for 10,000 psi working pressure, to 200° F. Semi-needle stem of *hardened* stainless steel. Available with graphited asbestos or Teflon packing.

Easy grip handle. Panel mounting. Female pipe connections, sizes ⅛" up to ½".

Ask for new catalog No. 654, showing entire line.

Distributors in principal cities coast to coast.

CHECK RELIEF PLUG GLOBE NEEDLE

148

RM REPUBLIC MANUFACTURING CO.

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

HOW TOUGH CAN CONVEYING GET?

A 55' Carrier Heavy Duty Conveyor. Capacity: 20 tons-per-hour of hot sintered coke. One 5 HP drive.

Check this list . . . see if you know of a material that is harder to handle than any of these.

ROCKET FUEL POWDER
HOT CEMENT CLINKER
FLY ASH
DRIED SEWAGE SLUDGE
COKE BREEZE
DRY CALCIUM CARBIDE
TITANIUM DIOXIDE
WET SUGAR
SILICON-CARBIDE
MACHINE TURNINGS
SINTERED ORE
SLAG
CORROSIVE CHEMICALS
FRAGILE CRYSTALS

THE materials at right, above, have *one* thing in common: they are all being conveyed efficiently and economically with Carrier Natural-Frequency Conveyors.

Here's why plants processing these materials turned naturally to Carrier Natural-Frequency:

> **A lot of the materials had proved too sharp or oily for belt or flight conveyors. Others were so sticky they made screw conveyor cleaning a maintenance nightmare. Still others were too abrasive for apron and conventional vibrating conveyors. Some were subject to spillage in *any* ordinary conveyors.**

Carrier Natural-Frequency Conveyors solve all these problems. These amazing conveyors substitute the natural resonant action of coil springs for brute force. They require little, if any, more power to operate, empty, than to run the motor alone. And remember, *the lower the power requirements, the lower your maintenance.*

If you've got a material that's giving you conveying troubles of any kind, just jot it down on the coupon. The Carrier Natural-Frequency Conveyor may solve yours.

CARRIER ~~NATURAL-FREQUENCY~~ VIBRATING EQUIPMENT

Carrier Conveyor Corporation
205 N. Jackson St., Louisville 6, Kentucky

Gentlemen: We've been having trouble with_____

_____

_____

_____. Without obligation, please send Carrier Natural-Frequency Bulletin No. 111.

Firm_____

Street_____

City_____ State_____

Att: Mr._____ Dept._____

This Niagara Aero After Cooler also cools compressor jacket and intercooler water.

COMPRESSED AIR... Lower in Cost Dependably Drier and Cooler Trustworthy for Instrument Use

THE NIAGARA *AERO* AFTER COOLER offers a completely self-contained method replacing both shell-and-tube cooler and cooling tower. It is independent of a large supply of cooling water and consistently reduces compressed air temperatures to below ambient.

Drier air gives you better operation and lower costs in using all air-operated automatic instruments, tools and machines, paint spraying, sand blasting and moisture-free air cleaning.

Direct saving in the cost of cooling water saves the price of the Niagara *Aero* After Cooler in less than two years.

Niagara *Aero* After Cooler assures all these benefits because it cools compressed air or gas below the temperature of surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air through a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter, proven in service on the largest plant utility systems.

Write for Bulletin No. 130

NIAGARA BLOWER COMPANY

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District Engineers in Principal Cities of U. S. and Canada

AMERICAN STANDARDS

Gear Dimensions, Design, Inspection

SYSTEM FOR STRAIGHT BEVEL GEARS, B6.13—1955. $1.00

This system covers tooth proportions and dimensions of blanks for generated straight bevel gears of tooth ratios in general industrial use. The Standard describes the general basis of the system and shows the calculations used to obtain the recommended proportions and dimensions. Standard adopts 20 degrees as the pressure angle and includes an appendix providing data for calculating the dimensions of angular gears.

SPUR GEAR TOOTH FORM, B6.1—1932. 55¢

Gives the proportions of the tooth form for 14½-degree composite system, 14½- and 20-degree full depth involute systems, and 20-degree stub involute system, and the data for obtaining full involute tooth action on pinions of 31 teeth and smaller when using the 14½-full depth involute system, and on pinions of 17 teeth or smaller when using the 20-degree full depth involute system.

GEAR TOLERANCES AND INSPECTION, B6.6—1946. 80¢

Applies to spur, helical, bevel, and hypoid gears. The diameters considered are from ¾ to 100 inches. The pitches range from 1 to 32 diametral pitch. Allowances and tolerances for backlash are also treated.

20-DEGREE INVOLUTE FINE-PITCH SYSTEM FOR SPUR AND HELICAL GEARS, B6.7—1950. $1.50

Presents tooth proportions, dimensions of gears and enlarged pinions, tolerances on outside diameter of gears, design data for spur and helical pinions having 9, 8, and 7 teeth, formulas for calculating the values of the various tables, and terminology.

FINE-PITCH STRAIGHT BEVEL GEARS, B6.8—1950. $1.00

Covering generated straight bevel gears of 20 diametral pitch and finer, this Standard gives the gear dimensions, the tooth proportions for 1-diameter pitch, general specifications, dimensions and tolerances for gear blanks, nomenclature, and symbols.

DESIGN FOR FINE-PITCH WORM GEARING, B6.9—1950. $1.50

A design procedure for worms and worm gears with axes at right angles, this Standard gives the proportions of worms and worm gears, values of diameter for all possible combinations of leads and lead angles within the Standard, tooth proportions based on normal pitch for all combinations of standard axial pitches and lead angles, and an extensive table of profile deviations and pressure angle changes.

INSPECTION OF FINE-PITCH GEARS, B6.11—1951. $2.50

Outlines methods for determining gear quality, recommends the tolerances for spur, helical, straight, spiral, bevel, hypoid gears, worm and worm gears, and various gear blank elements. It specifies the backlash in gears, gives recommendations for machining gear blanks, the pin measurements for spur gears, and the procedures for making comparator layouts to check gear and worm profiles. It also includes directions for using master jaws, classifications for various degrees of surface roughness, waviness and lay, and a list of symbols for use on drawings.

LETTER SYMBOLS FOR GEAR ENGINEERING, B6.5—1954. $1.00

Includes special symbols of the field as well as those common to other branches of engineering and science.

GEAR NOMENCLATURE, B6.10—1954. $1.50

Provides a system of terms and definitions with illustrative figures applicable to investigations and discussions of gear problems grouped under the following classifications: General designations, kinds of gears, pitch surfaces, boundary surfaces, principal planes, principal directions, elements of gear teeth, linear and circular dimensions, angular dimensions, numbers and ratios, and a miscellaneous group.

NOMENCLATURE FOR GEAR TOOTH WEAR AND FAILURE, B6.12—1954. $1.50

Lists, defines, and illustrates the terms for the more common types of wear and failure of teeth of metallic gears such as normal, abrasive, scratching, and overload wear; plastic yielding; rolling and peening; welding; surface fatigue; pitting; other forms of surface deterioration, and tooth breakage.

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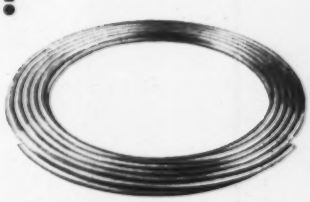

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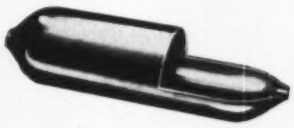

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Wolverine can bend, spin, flare, bead, expand, reduce or otherwise fabricate tubing to your requirements.

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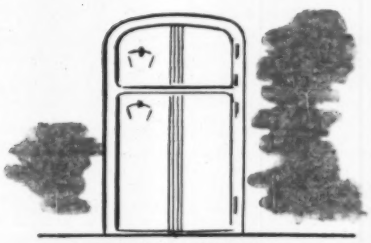

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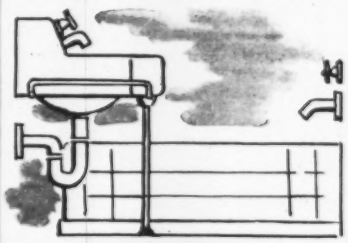

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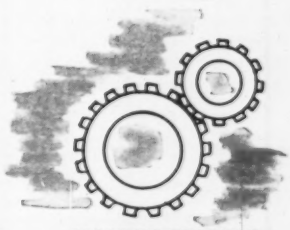

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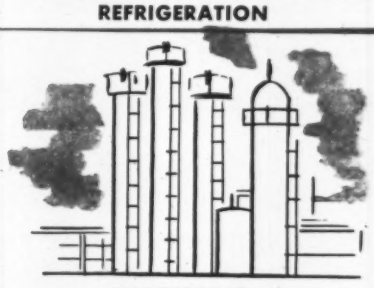

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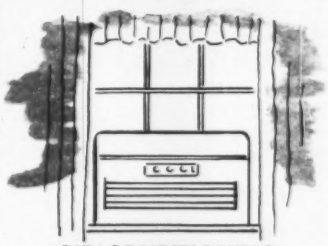

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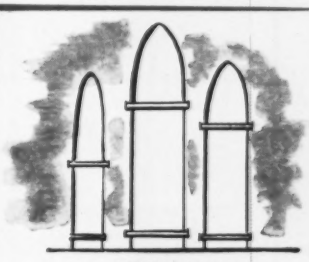

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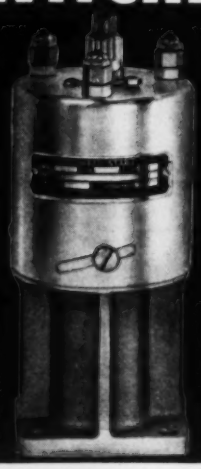

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High repeatable accuracy

The Synchro-Start governor Model GA-3 has a housing suitable for mounting on an AND20005 aircraft tachometer drive pad. It contains three snap action switches that may be set to open and close circuits at any speeds between 1200 to 10,000 RPM.

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Lake Shore plates are made of fine grained flaw-free "Lakenite" iron . . . and are available machined, ground or hand scraped. Standard plates are available in a wide range of sizes; and for special requirements, Lake Shore engineers can design special plates to any size.

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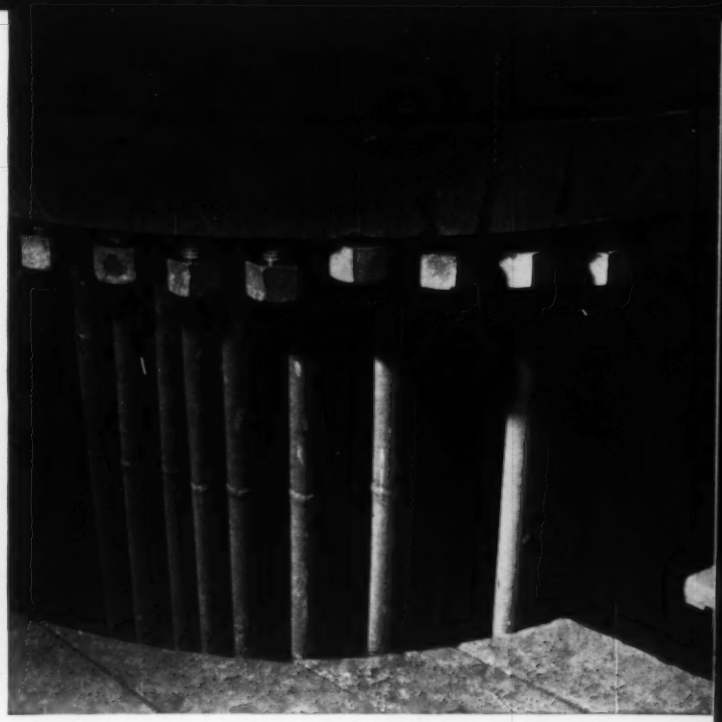
FOR SCUFF-RESISTANT BEAUTY. This Sunroc water cooler has, as standard equipment, a Stainless Steel kick plate for protection against scuffing and corrosion when floors are mopped. The deep drawn top is also made from Stainless. It's bright and inviting, and easy to clean.



FOR LONG, HARD SERVICE. Some of the Stainless Steel tubes in this bundle are 20 years old, despite the fact that they have been in continual service in a thermal cracking unit at a major southwestern oil refinery. Even though some of them have been lengthened by heliarc welding, they still retain their ability to handle corrosive products.

NOTHING *can equal* *Stainless Steel*

FOR SANITATION. This is a Stainless Steel rotary washer at a baby food plant of Gerber Products Company. Stainless Steel was used because of its great corrosion resistance, because it will not contaminate the food products, because it is so very easy to clean. Gerber's uses a lot of Stainless Steel processing equipment—including peelers, bins, steamers, holding tanks and filling machines.

• No other design material can match Stainless Steel in its *combination* of desirable properties: corrosion resistance, strength and hardness, beauty, cleanability and easy fabrication. When seeking a source of supply, remember that United States Steel offers the widest range of types, finishes and sizes available in the United States.

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USS STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS
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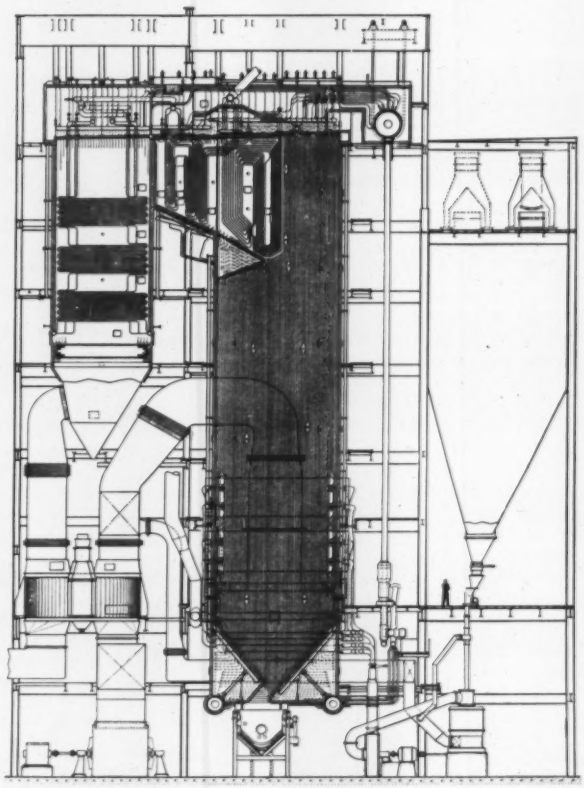
UNITED STATES STEEL

RIVER ROUGE STATION

The Detroit Edison Company

C-E controlled circulation boilers



The C-E Unit shown above is presently under construction for the River Rouge Station of The Detroit Edison Company at River Rouge, Michigan.

This boiler is designed to serve a 260,000 kw turbine-generator operating at a throttle pressure of 2000 psig at maximum rated capacity with a primary steam temperature of 1050 F, reheated to 1000 F.

It is of the controlled-circulation, radiant reheat type with a separated furnace arrangement. Secondary superheater surface is at the outlet of one furnace and reheater surface at the outlet of the other. Primary superheater sections and economizer surface follow both the secondary superheater and reheater surfaces. Regenerative air heaters follow the economizer surfaces. The section shown above is taken through the superheater furnace.

Pulverized coal firing is employed, using bowl mills and tilting, tangential burners. Arrangements are made to use oil as an alternate fuel.

B-876

C-E

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Combustion Engineering Building
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with strong chemistry minor, preferably with training in surface study techniques, for basic wear studies, or

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Employment Manager

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Electronic Defense Laboratory
(located in the San Francisco Bay region)
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mechanical engineers

Preferably with experience in military and electronic equipment.

Sylvania offers the finest facilities and equipment available. We also provide financial support for advanced education, as well as a liberal insurance, pension and medical program.

Our laboratory is located five miles from Palo Alto in the San Francisco Bay area, close to excellent schools and universities, unexcelled living conditions, ideal climate and ample housing.

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challenging, creative, remunerative

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for experienced

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Qualifications will include background in the design of industrial plant facilities required to supply utility services to chemical processes. Applicable design experience should be in steam generation and distribution, water supply and treatment, refrigeration, fire protection, outside pipe lines, process waste disposal and industrial furnaces.

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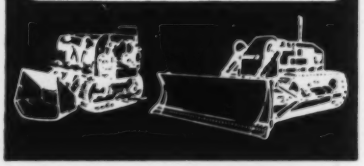

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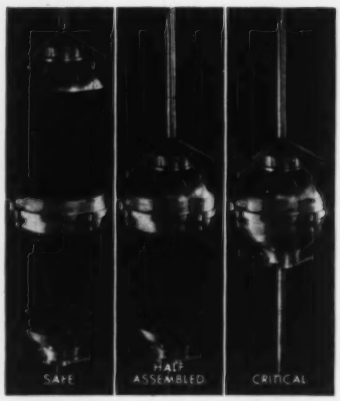

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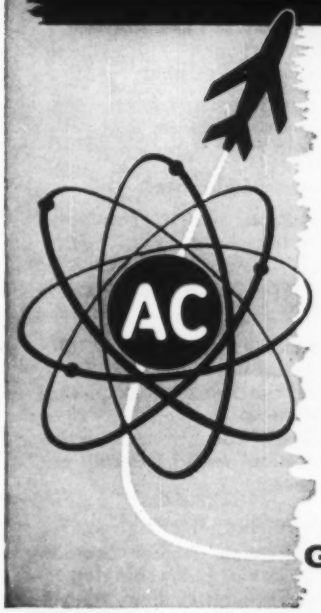

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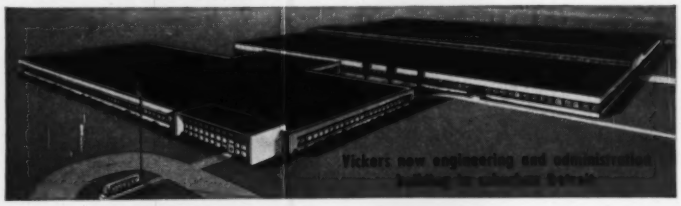

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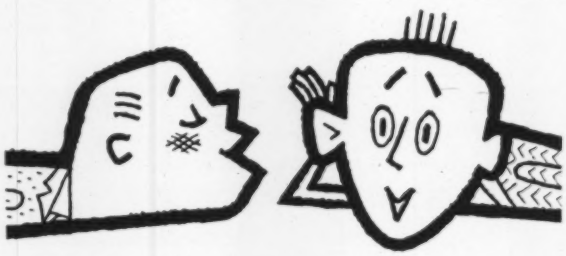

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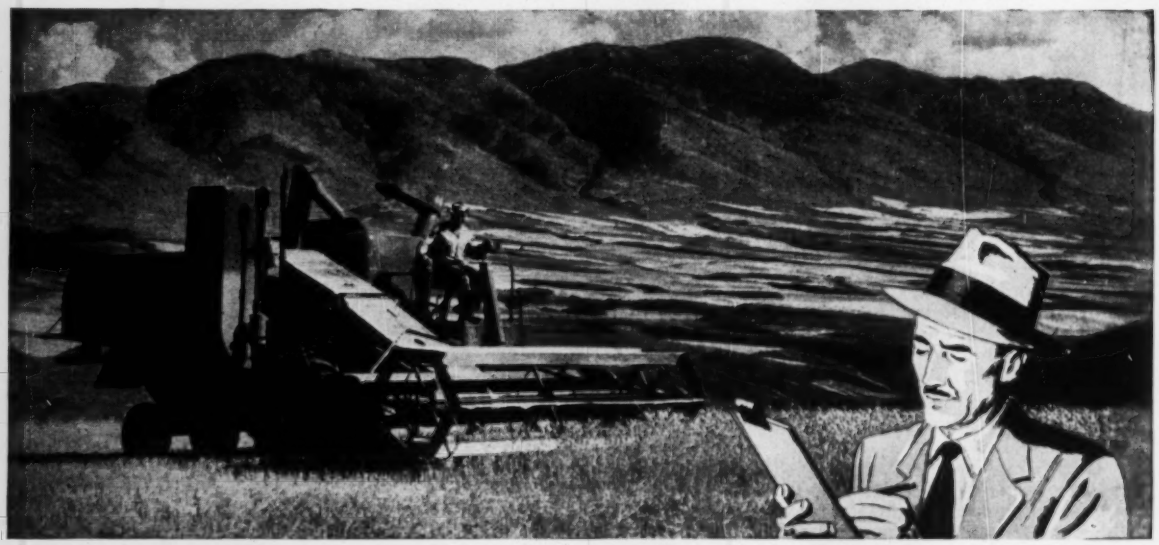

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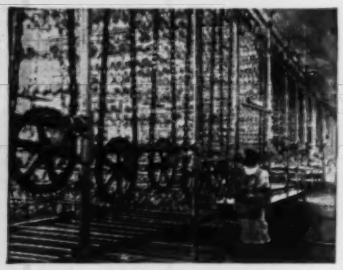

Roller chain is often low-cost, practical answer to conveying as on this 1/5-mile long cookie dryer in a bakery.

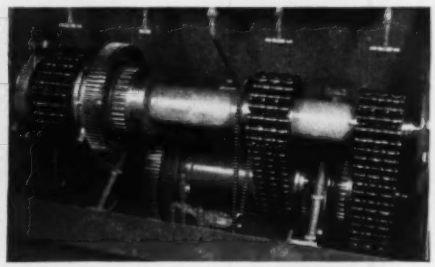

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FIG. 19003 WE—900-Pound Steel Pressure Seal Gate Valve.

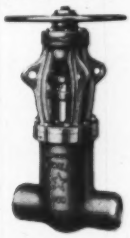

FIG. 11365 WE—Steel Pressure Seal Horizontal Lift Check Valve for 1500 Pounds W.S.P.

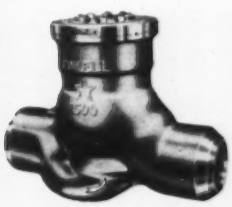

FIG. 3031 WE—Steel Globe Valve for 300 Pounds W.S.P.

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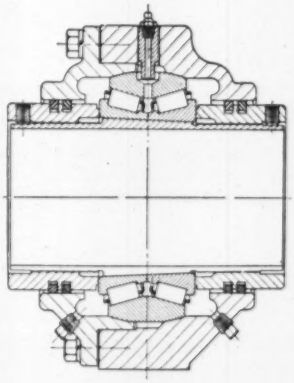
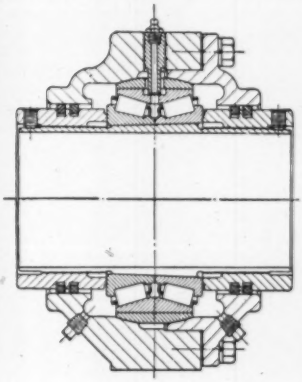
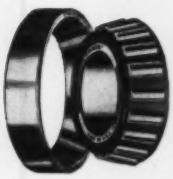


How **DODGE MANUFACTURING CORPORATION,** Mishawaka, Ind., mounts Timken bearings in the Dodge-Timken All-Steel pillow block. Above: non-expansion block with fixed bearing. Below: expansion block with floating bearing.





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